Appendix E: Draft Wetland and Floodplain Statement of Findings

Reconstruction of the Furnace Creek Water Collection System

Death Valley National Park

Lead Agency: National Park Service

Draft Wetland and Floodplain Statement of Findings

Recommended:

Superintendent, Death Valley National Park Date

Concurrence:

Regional Safety Officer Date

Certification of Technical Adequacy and Servicewide Consistency:

Chief, Water Resources Division, National Park Service Date

Approved:

Director, Pacific West Region, National Park Service Date

Purpose of this Statement of Findings

The purpose of this Wetland and Floodplain Statement of Findings is to review the preferred alternative under Reconstruction of the Furnace Creek Water Collection System in sufficient detail to:

- Avoid, to the extent possible, the long-term and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative
- Describe the effects on floodplain and wetland values associated with the proposed action
- Provide a thorough description and evaluation of mitigation measures developed to achieve compliance with Executive Order 11988 (Floodplain Management), Executive Order 11990 (Protection of Wetlands), National Park Service Director's Order 77-2 and Procedural Manual 77-2: Floodplain Management and National Park Service Director's Order 77-1 and Procedural Manual 77-1: Wetland Protection
- Avoid the long-term and short-term adverse impacts associated with the occupancy and modification of floodplains to the extent possible and restore, when practicable, natural floodplain values previously affected by land use activities within floodplains
- Ensure "no net loss" of wetland functions or values

Alternatives Considered

The National Park Service is preparing the Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement to evaluate four alternatives with various water production options. Under Alternative 1 (No Action), the project area would remain unchanged, except for normal maintenance and repair. Alternative 2, Alternative 3, and Alternative 4 (the action alternatives) would rebuild the outdated water supply system in the Furnace Creek area to deliver safe and reliable potable and nonpotable water to the project area. The action alternatives include options such as rebuilding the spring infiltration galleries, installing new groundwater monitoring and production wells, collecting water from any source and treating the water using reverse osmosis water treatment technology, and improving flow to biological riparian areas and the culturally important mesquite bosque. All three action alternatives would separate the potable and nonpotable water systems in the project area, and provide nonpotable water from the Inn Tunnel and a relocated Furnace Creek Wash collection gallery.

Alternative 1 (No Action)

The No Action Alternative represents ongoing implementation of the current management direction for the Travertine-Texas Springs water supply system. Under this alternative, no comprehensive changes or new management activities would take place with respect to the Furnace Creek water supply. Alternative 1 represents the management approach that the National Park Service is currently following, and would continue to follow if no further agency action were taken (see Chapter II, Alternatives, figures II-1 and II-2).

Generally, water from the Travertine Springs and Furnace Creek Wash flows by gravity to a 2-million gallon tank located northeast of the Furnace Creek Inn. From the 2-million gallon tank, a portion of the water is delivered directly to Xanterra facilities (Furnace Creek Inn, Furnace

Creek Ranch, and Furnace Creek Golf Course) and a portion is transported to a 500,000-gallon tank. From the 500,000-gallon tank, the water flows by gravity to National Park Service facilities, including park headquarters, visitor center, and three campgrounds, and to the Timbisha Shoshone Tribe residential/administrative area. Nonpotable water from the Inn Tunnel flows by gravity to Xanterra facilities for irrigation purposes.

Under Alternative 1, a total of 335 gallons per minute (gpm) would be allocated for riparian discharges. Of this total, 135 gpm would continue to be discharged at Travertine Springs Line 1, and 200 gpm at Texas Springs. The measurement box at the Inn Tunnel would continue to have an 8-inch overflow pipe, which would direct 155 gpm to a percolation trench and return water to the groundwater flow system for groundwater recharge. Water directed to the percolation trench would be available for use by the mesquite bosque located on Furnace Creek Fan. The stream channels downstream of Travertine Springs Line 1 have been shown to provide the greatest aquatic habitat values within the project area (Threloff 2001). At Texas Springs,[1] the original spring outflow and aquatic community for Texas Springs was completely eliminated when the current water delivery system was developed in the 1970s. An outflow stream was re-created below this spring's source in 2000. The current stream habitat typically receives all of the total spring flow. The water withdrawals from the water sources to meet the average daily flow requirements are shown in table II-2 in Chapter II, Alternatives.

Alternative 2

Construction activities under Alternative 2 would include replacement of the pipeline and air relief valves along Highway 190, reconstruction of the spring collection boxes at Travertine Springs Lines 3 and 4, the drilling and construction of 2 groundwater production wells in the Texas Springs Syncline, drilling and construction of 6 groundwater monitoring wells, the placement of approximately 17,200 linear feet of pipeline, construction of maintenance roads for the new groundwater production and monitoring wells, construction of a 3,000-gallon underground regulating storage tank, relocation of the Furnace Creek Wash collection gallery to the downstream end of the wash, and construction of a reverse osmosis water treatment plant with an approximate footprint of 40 feet by 60 feet near the existing 2-million gallon water storage tank (see Chapter II, Alternatives, figures II-3 and II-4).

Two culverts would be installed under Highway 190 in the vicinity of Travertine Springs to convey spring water from Travertine Springs Lines 1 and 2 under the highway. Each culvert would be approximately 36 inches in diameter, and would be sufficiently sized to convey flood flows. The proposed culvert located near the existing Travertine Springs measurement box would replace the existing 24-inch culvert. In addition, a 36-inch culvert would be installed at Badwater Road to convey riparian flows to Furnace Creek Fan. All culverts would be installed using open trench construction techniques.

Under Alternative 2, maximum daily flow requirements would need to be met approximately 10% of a calendar year. The average daily flow requirements would need to be met 100% of the calendar year, and would constitute the water withdrawals from the Furnace Creek system

---

[1] Uncertainty remains as to whether the observed erosion and down-cutting in the current Texas Springs channels is a result of inadequate channel stability due to previous losses of riparian vegetation, or due to the fact that the reestablishment of riparian discharges has occurred in an inappropriate location (i.e., the historic channel may have been located to the west of where riparian water is currently being discharged) (U.S. Fish and Wildlife Service [USFWS] 2003).

approximately 90% of the year. To meet maximum daily flow requirements, Alternative 2 would collect approximately 600 gpm of potable water and 900 gpm of nonpotable water, and release approximately 663 gpm of riparian water. To meet average daily flow requirements, Alternative 2 would collect approximately 429 gpm of potable water and 780 gpm of nonpotable water. Approximately 663 gpm of riparian would be released from the collection system at Texas Springs and Travertine Springs Lines 1 and 2 to restore riparian flow downstream of the springs. Under average daily flow requirements, less potable water would be pumped from the proposed groundwater wells. The increased pumping needed to meet maximum daily flow requirements would not substantially reduce discharge from the spring outlets due to the short-term and episodic nature of these flow requirements. The water withdrawals from the water sources to meet the average daily flow requirements are shown in table II-2 in Chapter II, Alternatives. The restoration effort would include the incorporation of riparian water release measures that would reduce erosion and promote groundwater infiltration.

The exact effects of groundwater pumping are unknown at this time; however, discharges from spring outlets would be expected to decline as the groundwater flow system reaches a new equilibrium. Computer modeling of the Texas Springs Syncline aquifer indicates that the overall reduction in flow from the Travertine and Texas Springs system is expected to equal the volume of groundwater pumped in order to meet average potable demand (Bredehoeft et al 2005).[2] The response to groundwater pumping would likely not occur immediately at the springs, as the National Park Service expects a time lag between the initiation of groundwater pumping and the effects observed at the springs and other discharge points. The length of the time lag could range from months to years and would depend upon the pumping rate and subsurface hydrogeologic conditions, which are not fully characterized. Full impacts of pumping may not be observed for 10 to 20 years after pumping begins. Due to the hydrogeologic conditions of the area, it would be likely that the effects would be spread reasonably evenly throughout discharge points in the Furnace Creek area. However, there may be some variation in the effects at individual discharge points because of local differences in aquifer hydraulic properties and the distance of the discharge points from the groundwater pumping wells.

Despite the uncertainty regarding reduction in flow at any specific discharge point, the National Park Service believes that the hydrogeology of the Furnace Creek area is sufficiently homogenous that assumptions can be made regarding the effects of groundwater pumping on spring flow. The average daily flow requirements may decrease discharges from spring outlets as discussed below. If the characteristics of the Texas Springs Syncline aquifer and the effects of pumping on springs are substantially different than anticipated by the National Park Service, the groundwater pumping plan will be modified. Potential modifications would rely upon data from the groundwater monitoring well network in Furnace Creek, field observations during groundwater production well installation, results of historic groundwater pumping tests, and monitoring of spring discharge following the initiation of groundwater pumping to evaluate response of the aquifer to stress from groundwater withdrawal in the Texas Springs Syncline. In order to minimize the effect of groundwater pumping on spring discharge, optimizing extraction rates

2 In 2005, data collected during a 72-hour groundwater pumping test indicated that continual extraction of groundwater at approximately 450 gpm would result in approximately 19 feet of drawdown in the Texas Springs Syncline aquifer. The hydrologic properties of the aquifer, such as direction and rate of groundwater flow, were also calculated using data from the 2005 test; computer modeling of the Texas Springs Syncline aquifer confirmed the hypothesis that pumping of groundwater would eventually affect discharge of springs in the Furnace Creek area (Bredehoeft et al 2005).

among the proposed groundwater production wells may include refinement of the groundwater pumping schedule or altering the volume of water pumped from individual wells.

Based on an average water usage rate of 343 gpm of potable water (requiring 429 gpm of raw water with approximately 129 gpm supplied by groundwater wells) and computer modeling of the Texas Springs Syncline aquifer, the National Park Service estimates that discharges from the spring system may decrease an average of approximately 7% under Alternative 2 (NPS 2004c,d).[3] Flows from Travertine Springs Line 1 and Line 2 would be reduced to 126 gpm and 351 gpm, respectively. Flows from Texas Spring would be reduced to 186 gpm. Reconstruction of the Travertine Springs Line 3 and Line 4 spring boxes would likely improve the water collection capabilities at these springs, and therefore the spring output at these sources would not be reduced by 7%.

Groundwater pumping from production wells in the Texas Springs Syncline would not be anticipated to reduce flows from the Inn Tunnel or Furnace Creek Wash collection systems by 7% as these systems draw upon groundwater flowing in the alluvium of Furnace Creek Wash. Groundwater availability in Furnace Creek Wash would be affected by a decrease in flow from Travertine Springs due to groundwater pumping from the syncline; however, net groundwater flows in Furnace Creek Wash would be enhanced by increased riparian releases at Travertine Springs Line 2. In addition, reconstruction of the Furnace Creek Wash collection gallery would improve the water collection capabilities.

The increased pumping needed to meet maximum daily flow requirements (i.e., 300 gpm vs. 129 gpm from production wells) would not substantially reduce discharge from the spring outlets due to the short-term and episodic nature of these flow requirements. A temporary reduction of spring discharge due to pumping to meet maximum daily demand requirements could occur in addition to the reduction caused by the average pumping rate; however, it is anticipated that the effects from maximum daily demand pumping would be dampened and attenuated by the time those stresses would be observed in spring discharge. The National Park Service would select a pumping schedule that would minimize fluctuations in water levels (i.e., use a low pumping rate over a longer period of time rather than a high pumping rate over a shorter period of time) when feasible.

The 20% concentrate water output flow from the reverse osmosis water treatment plant would be transported to Furnace Creek Fan and discharged into a percolation trench for groundwater recharge. The concentrate water would be conveyed through 3,700-linear feet of 4-inch diameter pipeline which would be installed along a route that includes both previously disturbed and undisturbed areas (see figure II-3). Installation of the percolation trench in Furnace Creek Fan would disturb an area approximately 20 feet wide by 200 feet in length, and up to 10 feet in depth. To meet average daily flow requirements, approximately 86 gpm of concentrate water would be discharged through percolation to groundwater in Furnace Creek Fan. This discharge volume would increase during maximum daily flow requirement periods to 120 gpm, as raw water input volumes would increase from 429 gpm to 600 gpm. The concentrate water discharged through groundwater percolation would contain higher levels of dissolved minerals (such as arsenic, fluoride, and boron) and TDS than naturally occurring groundwater in the Furnace Creek area.

---

[3] It is estimated that an average of 129 gpm would be pumped from the proposed groundwater wells under this alternative, which would be approximately 7% of total flow (i.e., 1,812 gpm) collected or discharged from the Furnace Creek system under the No Action Alternative.

Groundwater recharge and enhancement of subsurface flows in Furnace Creek Fan through percolation of concentrate water discharge flows under Alternative 2 could provide a water source for the mesquite bosque located near the Timbisha Shoshone Indian reservation.

Riparian-Wetland Restoration

Alternative 2 would release approximately 663 gpm from Travertine Springs Line 1 and Line 2 and Texas Springs for riparian and wetland restoration purposes. The exact effects of groundwater pumping upgradient of Travertine and Texas Springs on spring discharges are unknown at this time. Computer modeling of the Texas Springs Syncline aquifer indicates that groundwater pumping could decrease discharges from the spring system resulting in reductions of riparian water releases. The National Park Service estimates that spring discharges may decrease by approximately 7% as a result of groundwater pumping under Alternative 2, which would potentially reduce existing wetland habitats accordingly.[4]

Implementation of the measures described under the Riparian Water Releases section below would ensure that the riparian water releases would beneficially improve park resources through the reestablishment of historic wetland and riparian areas in the Travertine and Texas Springs areas. Groundwater recharge and subsurface flows in Furnace Creek Wash could provide a water source for the mesquite bosque located near the Timbisha Shoshone Indian reservation.

Although the exact number of acres that would be restored is unknown, an estimation of the number of acres of restored wetland and riparian habitat was developed based on the allocated flow rates, historic wetland locations, and previous assessments of eliminating water diversion activities (Threloff and Koenig 1999). Using the general restoration methods described in the Proposed Compensation section below, it is anticipated that Alternative 2 would restore approximately 19 acres of palustrine wetlands, including approximately 11 acres at Travertine Springs, 3 acres at Texas Springs, and 5 acres at Furnace Creek Wash, and 19 acres of riverine wetlands (see figure E-1).

Alternative 3 (Preferred Alternative)

Alternative 3 project components would include the drilling and installation of 2 to 3 groundwater production wells and 7 groundwater monitoring wells in the Texas Springs Syncline, placement of approximately 13,600 linear feet of pipeline, the construction of a maintenance road for the new wells, relocation of the Furnace Creek Wash collection gallery to the downstream end of the wash, construction of a 3,000-gallon underground regulating storage tank, and construction of a reverse osmosis water treatment plant housed in an approximately 40-foot by 60-foot structure near the existing 2-million gallon water storage tank (see Chapter II, Alternatives, figures II-5 and II-6).

Three culverts would be installed under Highway 190 in the vicinity of Travertine Springs to convey spring water from Travertine Springs Lines 1, 2, 3, and 4 under the highway. Each culvert would be approximately 36 inches in diameter, and would be sufficiently sized to convey flood flows. The proposed culvert located near the existing Travertine Springs measurement box would

---

[4] The exact number of acres of wetland loss due to groundwater pumping is unknown. The loss of wetlands would depend on topography, slope, channel incision, plant species evaporation rates, and other physiological, geomorphic and environmental factors. For the purposes of this document, it is assumed that the loss of wetlands would directly correlate with the spring flow reduction at a 1:1 ratio.

replace the existing 24-inch culvert. The culvert downslope from Travertine Springs Lines 3 and 4 would replace an existing 6-inch culvert at this location. In addition, a 36-inch culvert would be installed at Badwater Road to convey riparian flows to Furnace Creek Fan. All culverts would be installed using open trench construction techniques.

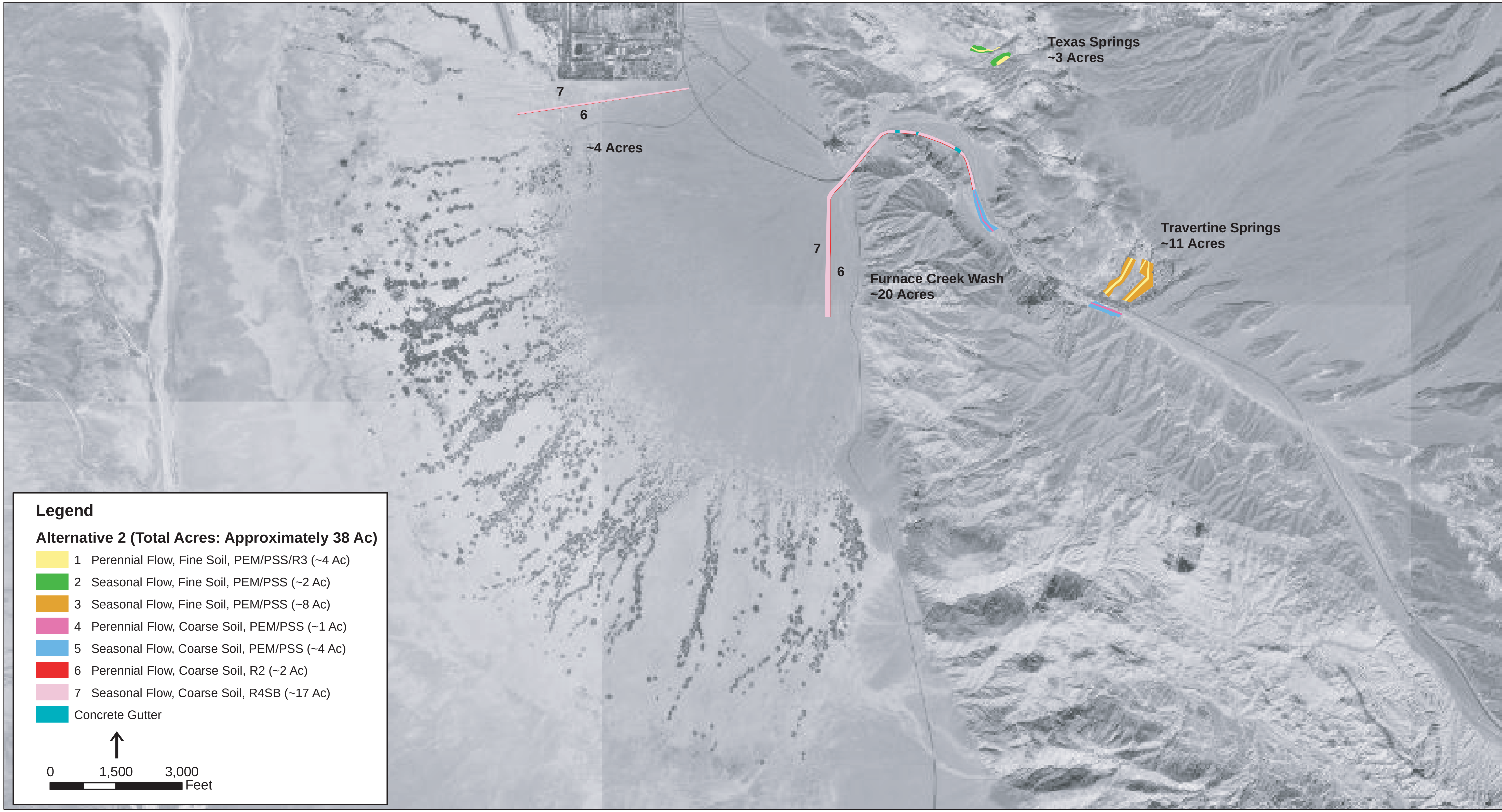
Under Alternative 3, maximum daily flow requirements would need to be met approximately 10% of a calendar year. The average daily flow requirements would need to be met 100% of the calendar year, and would constitute the water withdrawals from the Furnace Creek system approximately 90% of the year. To meet maximum daily flow requirements, Alternative 3 would collect approximately 600 gpm of potable water and 900 gpm of nonpotable water, and release approximately 770 gpm of riparian water. To meet average daily flow requirements, Alternative 3 would collect approximately 429 gpm of potable water and 780 gpm of nonpotable water, and release approximately 770 gpm of riparian water. Under average daily flow requirements, less potable water would be pumped from the proposed groundwater wells. The increased pumping needed to meet maximum daily flow requirements would not substantially reduce discharge from the spring outlets due to the short-term and episodic nature of these flow requirements. The water withdrawals from the water sources to meet the average daily flow requirements are shown in table II-2 in Chapter II, Alternatives. The restoration effort would include the incorporation of riparian water release measures that would reduce erosion and promote groundwater infiltration.

The exact effects of groundwater pumping are unknown at this time; however, discharges from spring outlets are expected to decline as the groundwater system reaches a new equilibrium. Computer modeling of the Texas Springs Syncline aquifer indicates that the overall reduction in flow from the Travertine and Texas Springs system is expected to equal the volume of groundwater pumped to meet average daily demand (Bredehoeft et al 2005).[5] The response to groundwater pumping would likely not occur immediately at the springs, as the National Park Service expects a time lag between the initiation of groundwater pumping and the effects observed at the springs and other discharge points. The length of the time lag could range from months to years and would depend upon the pumping rate and subsurface hydrogeologic conditions, which are not fully characterized. Full impacts of groundwater pumping may not be observed for 10 to 20 years after pumping begins. Similar to Alternative 2, due to the geohydrologic conditions of the area, it would be likely that the effects would be spread reasonably evenly throughout discharge points in the Furnace Creek area. However, there may be some variation in the effect at individual discharge points because of local differences in aquifer properties and the distance of the discharge points from the groundwater pumping wells.

Despite the uncertainty regarding reduction in flow at any specific discharge point, the National Park Service believes that the hydrogeology of the Furnace Creek area is sufficiently homogenous that assumptions can be made regarding the effects of groundwater pumping on spring flow. The average daily flow requirements may decrease discharges from spring outlets as discussed below. If the characteristics of the Texas Springs Syncline aquifer and the effects of pumping on springs are substantially different than anticipated by the National Park Service, the groundwater pumping plan will be modified. Potential modifications would rely upon data from the

[5] In 2005, data collected during a 72-hour groundwater pumping test indicated that continual extraction of groundwater at approximately 450 gpm would result in approximately 19 feet of drawdown in the Texas Springs Syncline aquifer. The hydrologic properties of the aquifer, such as direction and rate of groundwater flow, were also calculated using data from the 2005 test; computer modeling of the Texas Springs Syncline aquifer confirmed the hypothesis that pumping of groundwater would eventually affect discharge of springs in the Furnace Creek area (Bredehoeft et al 2005).

Figure E-1
Alternative 2: Proposed Areas of Wetland Restoration



NOTE: This figure depicts one particular flow path on the Furnace Creek alluvial fan. The flow path will vary seasonally and may not follow this particular path.

SOURCE: Environmental Science Associates and National Park Service

groundwater monitoring well network in Furnace Creek, field observations during groundwater production well installation, results of historic groundwater pumping tests, and monitoring of spring discharge following the initiation of groundwater pumping to evaluate response of the aquifer to stress from groundwater withdrawal in the Texas Springs Syncline. In order to minimize the effect of groundwater pumping on spring discharge, optimizing extraction rates among the proposed groundwater production wells may include refinement of the groundwater pumping schedule or altering the volume of water pumped from individual wells.

Based on an average water usage rate of 343 gpm of potable water (requiring 429 gpm of raw water with 100% of potable water supplied by groundwater wells) and computer modeling of the Texas Springs Syncline aquifer, the National Park Service estimates that discharges from the spring system may decrease an average of approximately 24% under Alternative 3 (NPS 2004c,d).[6] Flows from Travertine Springs Line 1, Line 2, Line 3, and Line 4 would be reduced to 103 gpm, 287 gpm, 37 gpm, and 191 gpm, respectively. Flows from Texas Spring would be reduced to 152 gpm.

Groundwater pumping from production wells in the Texas Springs Syncline would not be anticipated to reduce flows from the Inn Tunnel or Furnace Creek Wash collection systems by 24% as these systems draw upon groundwater flowing in the alluvium of Furnace Creek Wash. Groundwater availability in Furnace Creek Wash would be affected by a decrease in flow from Travertine Springs due to groundwater pumping from the syncline; however, net groundwater flows in Furnace Creek Wash would be enhanced by increased riparian releases from Travertine Springs Lines 2, 3, and 4. In addition, reconstruction of the Furnace Creek Wash collection gallery would improve the water collection capabilities.

The increased pumping needed to meet maximum daily flow requirements (i.e., 600 gpm vs. 429 gpm from production wells) would not be expected to substantially affect discharge from the spring outlets due to the short-term and episodic nature of these well pumping requirements. A temporary reduction of spring discharge, due to pumping to meet maximum daily demand requirements, would occur in addition to the reduction caused by the average pumping rate. However, it is anticipated that the effects of maximum daily demand pumping would be dampened and attenuated by the time those stresses are observed in spring discharge. The National Park Service would select a pumping schedule that would minimize fluctuations in water levels (i.e. use a low pumping rate over a longer period of time rather than a high pumping rate over a shorter period of time) when feasible.

Similar to Alternative 2, Alternative 3 would treat potable water using a reverse osmosis water treatment plant. Concentrate water would be directed to Furnace Creek Wash and discharged into a percolation trench for groundwater recharge. The concentrate water would be conveyed to the wash through existing 10-inch and 12-inch water lines (see figure II-5). Installation of the percolation trench in Furnace Creek Wash would disturb an area approximately 20 feet wide by 200 feet in length, and up to 10 feet in depth. To meet average daily flow requirements, approximately 86 gpm of concentrate water would be discharged to groundwater. This discharge volume would increase during maximum daily flow requirement periods to 120 gpm, as raw water input volumes would increase from 429 gpm to 600 gpm. The concentrate water discharged

[6] It is estimated that an average of 429 gpm would be pumped from the proposed groundwater wells under this alternative, which would be approximately 24% of total flow (i.e., 1,812 gpm) collected or discharged from the Furnace Creek system under the No Action Alternative.

through groundwater percolation would contain higher levels of dissolved minerals (such as arsenic, fluoride, and boron) and TDS than naturally occurring groundwater in the Furnace Creek area. Groundwater recharge and enhancement of subsurface flows in Furnace Creek Wash through percolation of concentrate water discharge flows under Alternative 3 could provide a water source for the mesquite bosque located near the Timbisha Shoshone Indian reservation.

Riparian-Wetland Restoration

Alternative 3 would release approximately 770 gpm from Travertine Springs Lines 1, 2, 3, and 4 and Texas Springs for riparian and wetland restoration purposes. The exact effects of groundwater pumping upgradient of Travertine and Texas Springs on spring discharges are unknown at this time. Computer modeling of the Texas Springs Syncline aquifer indicates that groundwater pumping could decrease discharges from the spring system resulting in reductions of riparian water releases. The National Park Service estimates that spring discharges may decrease by 24% as a result of groundwater pumping under Alternative 3 which would potentially reduce existing wetland habitats accordingly.

Implementation of the measures described under the Riparian Water Releases section below would ensure that the riparian water releases would beneficially improve park resources through the reestablishment of historic wetland and riparian areas in the Travertine and Texas Springs areas. Groundwater recharge and subsurface flows in Furnace Creek Wash could provide a water source for the mesquite bosque located near the Timbisha Shoshone Indian reservation.

Although the exact number of acres that would be restored is unknown, an estimation of the number of acres of restored wetland and riparian habitat was developed based on the allocated flow rates, historic wetland locations, and previous assessments of eliminating water diversion activities (Threloff and Koenig 1999). It is anticipated that Alternative 3 would restore approximately 29 acres of palustrine wetlands, including approximately 20 acres at Travertine Springs, 3 acres at Texas Springs, and 6 acres at Furnace Creek Wash, and 31 acres of riverine wetlands (see Proposed Compensation section below) in the Furnace Creek area.

Alternative 4

Alternative 4 project components would include replacement of the pipeline and air relief valves along Highway 190, relocation of the Furnace Creek Wash collection gallery to the downstream end of the wash, construction of 5,450 linear feet of pipeline, construction of a reverse osmosis water treatment plant (with treated bypass water) housed in an approximately 40-foot by 60-foot structure near the existing 2-million gallon water storage tank, and 4 groundwater monitoring wells and associated maintenance road improvements and new road construction (see Chapter II, Alternatives, figures II-7 and II-8).

Two culverts would be installed under Highway 190 in the vicinity of Travertine Springs to convey spring water from Travertine Springs Lines 1 and 2 under the highway. Each culvert would be approximately 36 inches in diameter, and would be sufficiently sized to convey flood flows. The proposed culvert located near the existing Travertine Springs measurement box would replace the existing 24-inch culvert. In addition, a 36-inch culvert would be installed at Badwater Road to convey riparian flows to Furnace Creek Fan. All culverts would be installed using open trench construction techniques.

Alternative 4 would provide potable water from Travertine Springs Lines 2, 3, and 4 and Texas Springs, and would treat water using a reverse osmosis water treatment plant. Since the National Park Service would treat all potable water under this alternative (including bypass water), Travertine Springs Lines 2, 3, and 4 would not require reconstruction of spring collection boxes or clearing and grubbing of vegetation from the spring area. Nonpotable water would be provided from a rebuilt Furnace Creek Wash collection gallery as well as from Inn Tunnel. Riparian water would be released from Travertine Springs Lines 1 and 2 and Texas Springs to restore historic wetland and riparian habitat. The restoration effort would include the incorporation of riparian water release measures that would reduce erosion and promote groundwater infiltration.

Similar to Alternatives 2 and 3, maximum daily flow requirements would need to be met approximately 10% of a calendar year. The average daily flow requirements would need to be met 100% of the calendar year, and would constitute the water withdrawals from the Furnace Creek system approximately 90% of the year. To meet maximum daily flow requirements, Alternative 4 would collect approximately 600 gpm of potable water and 900 gpm of nonpotable water, and release approximately 412 gpm of riparian water. To meet average daily flow requirements, Alternative 4 would collect approximately 429 gpm of potable water and 780 gpm of nonpotable water, and release approximately 583 gpm of riparian water. Concentrate water output volumes in Alternative 4 would be the same as described under Alternative 2. No groundwater would be pumped under Alternative 4. The water withdrawals from the water sources to meet the average daily flow requirements are shown in table II-2 in Chapter II, Alternatives.

Riparian-Wetland Restoration

Alternative 4 would release water from Travertine Springs Line 1 and Line 2 and Texas Springs for riparian and wetland restoration purposes. Under maximum daily flow requirements, approximately 412 gpm (see table II-1 in Chapter II, Alternatives) would be released to the surrounding environment. Under average daily flow requirements, approximately 583 gpm (see table II-2 in Chapter II, Alternatives) would be released to the surrounding environment. Using the measures described under the Riparian Water Releases section, below, the National Park Service would ensure that the riparian water releases would beneficially improve park resources through the reestablishment of historic wetland and riparian areas in the Travertine and Texas Springs areas. Groundwater recharge and subsurface flows in Furnace Creek Wash could provide a water source for the mesquite bosque located near the Timbisha Shoshone Indian reservation.

Although the exact number of acres that would be restored is unknown, an estimation of the number of acres of restored wetland and riparian habitat was developed based on the allocated flow rates, historic wetland locations and previous assessments of eliminating water diversion activities (Threloff and Koenig 1999). Using the general restoration methods described in the Proposed Compensation section below, it is anticipated that Alternative 4 would restore approximately 19 acres of palustrine wetlands, including approximately 12 acres at Travertine Springs, 1 acre at Texas Springs, and 6 acres at Furnace Creek Wash, and 16 acres of riverine wetlands (see figure E-2).

Elements Common to All Action Alternatives

The following elements would be common to Alternative 2, Alternative 3 (Preferred Alternative), and Alternative 4.

Water Usage

The Reconstruction of the Furnace Creek Water Collection System alternatives would be designed to meet peak water demand periods when (1) Furnace Creek facilities are at full occupancy and require their maximum daily flows, and (2) during the peak irrigation season when the Furnace Creek Inn and Ranch grounds and golf course require their maximum daily flows of irrigation water. The maximum daily flow requirements would need to be met approximately 10% of a calendar year. The average daily flow requirements would need to be met 100% of the calendar year, and would constitute the water withdrawals from the Furnace Creek system approximately 90% of the year.

Maximum Daily Flow Requirements

The action alternatives have been designed to meet the maximum daily flow requirements of the Furnace Creek water users. The maximum daily flow requirements (over a 24-hour period) would be 600 gpm of potable water and 900 gpm of nonpotable water. The water withdrawals from the water sources to meet the maximum daily flow requirements are shown in table II-1 (see Chapter II, Alternatives).

Average Daily Flow Requirements

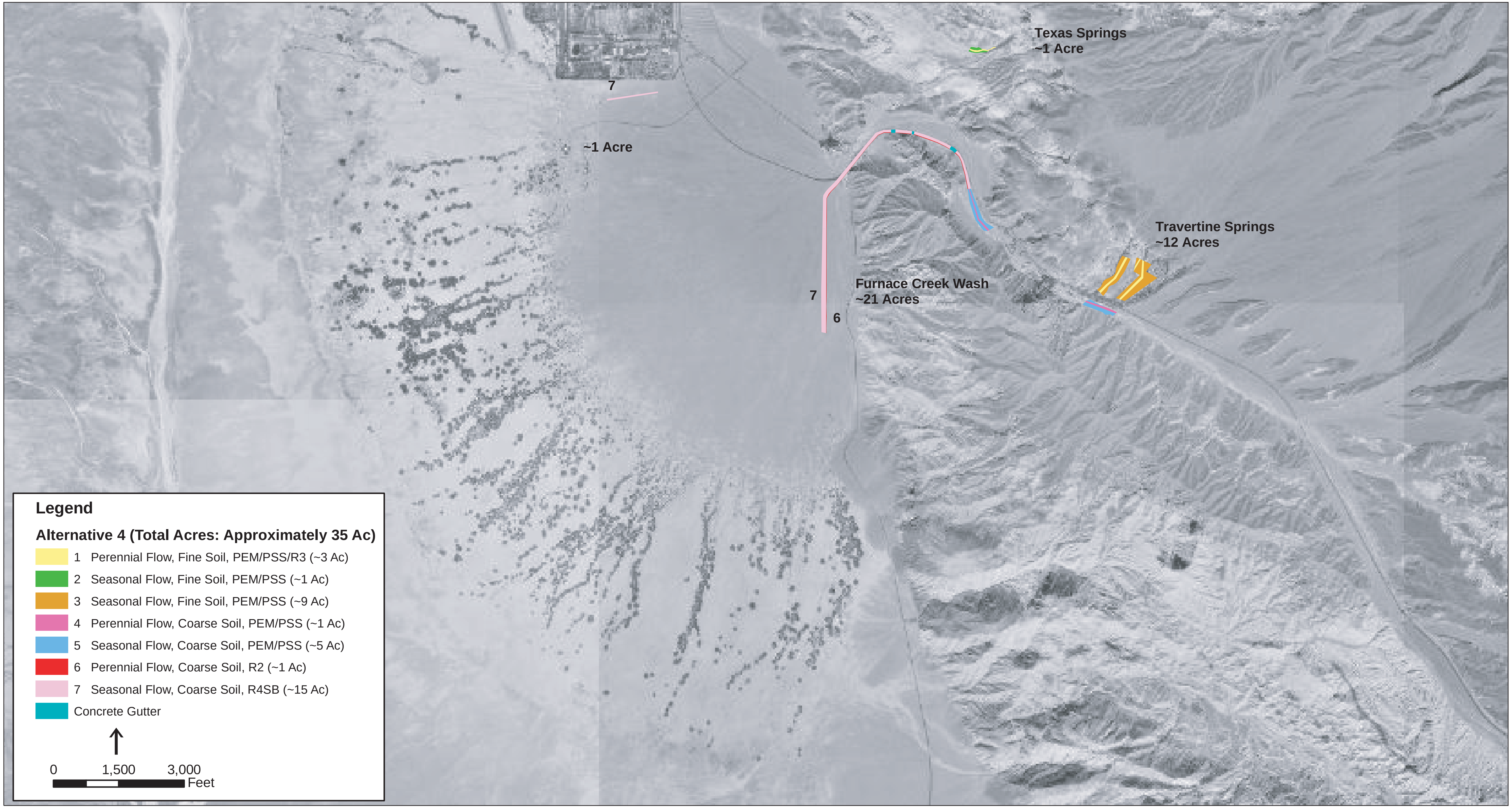
Under the action alternatives, the National Park Service's average water usage would be approximately 63 gpm of potable water. The Timbisha Shoshone Tribe's average water usage would be approximately 57 gpm of potable water. Xanterra's annual average water usage would be 223 gpm of potable water and 780 gpm of nonpotable water.[7] As noted in Appendix G, Water Use, Xanterra's monthly potable and nonpotable average water use is highest during the summer months and lowest during the winter months, resulting in an overall seasonal fluctuation in average potable and nonpotable demand. However, this variation in seasonal average demand is not substantial, and while seasonal patterns may raise or lower average daily demand, these variations are not anticipated to have substantial ramifications in the action alternatives beyond those associated with the annual average demand. Overall, average daily flow requirements (over a 24-hour period) would be 343 gpm of potable water and 780 gpm of nonpotable water. The water withdrawals from the water sources to meet the average daily flow requirements are shown in table II-2 in Chapter II, Alternatives.

Water Treatment

Under all action alternatives, potable water would be treated using reverse osmosis water treatment technology. The National Park Service would construct a reverse osmosis treatment plant consisting of pre-filtration and post-disinfection to remove viruses, bacteria, metals, arsenic, boron, fluoride, and TDS. The reverse osmosis treatment plant would be housed in an approximately 40-foot by 60-foot structure located near the 2-million gallon water storage tank and would have a treatment capacity of approximately 1 million gallons per day. The water treatment plant would include dark-sky compatible outdoor security lighting with motion detectors. A 1,500-gallon septic tank and 200-foot by 10-foot leach field would be installed adjoining the reverse osmosis water treatment plant to manage sewage flows produced by a bathroom for treatment plant employees.

[7] The Xanterra nonpotable water use figure does not include water used to irrigate the Furnace Creek Golf Course. Water from the Furnace Creek Inn and Furnace Creek Ranch swimming pools and from the Inn Tunnel would continue to be the primary source of irrigation water for the golf course.

Figure E-2
Alternative 4: Proposed Areas of Wetland Restoration



NOTE: This figure depicts one particular flow path on the Furnace Creek alluvial fan.
The flow path will vary seasonally and may not follow this particular path.

SOURCE: Environmental Science Associates and National Park Service

Reverse osmosis water treatment plants produce a concentrate water output of approximately 20% of raw water input, thereby requiring raw water inflow volumes of 120% of desired treated water output volumes. To meet the average daily potable water flow requirement of 343 gpm, the National Park Service would need to supply 429 gpm of untreated, raw water to the water treatment plant to provide an output of 343 gpm of treated potable water. The water withdrawals from the water sources to meet the average daily flow requirements are shown in table II-2 in Chapter II, Alternatives.

To meet maximum daily flow requirements of 600 gpm of treated potable water, (which needs to be met approximately 10% of the calendar year), the National Park Service would supply 600 gpm of untreated, raw water to the water treatment plant to provide an output of 480 gpm of treated potable water; the National Park Service also would rely upon drawdown of 120 gpm of stored, treated water in the 2-million gallon and 500,000-gallon tanks, rather than increasing raw water collection rates.

Water Meters

Under all action alternatives, the National Park Service would install a water metering system to accurately monitor the distribution of water in the Furnace Creek system.

Riparian Water Releases

Each of the action alternatives identifies riparian water releases to restore historic wetland and riparian habitat. The National Park Service would use the following general approach to return flows to the Travertine and Texas Springs systems and to address energy dissipation, reduce evaporative losses, slow water surface flow velocity to promote infiltration back into the subsurface, and reduce erosion.

- Penetrate the sides of collection boxes to install dispersion piping and valves so that spring water can be dispersed and released gradually. Perforate the sides of the collection boxes above the piping/valves to allow additional water releases from the sides of the collection boxes. Increased releases may be made over time as native riparian vegetation re-establishes.
- Build narrow and shallow infiltration ditches downstream of the spring outlet to provide the spring water with a preferential pathway for reinfiltration of unused water gathered from the spring collection system. The infiltration ditches would be approximately 6 inches to 1 foot deep. The trenches would be filled with permeable backfill, and may include drip systems or weep pipes. The infiltration ditches would be oriented downslope and cross-contour.
- Install temporary ground diffusion piping (for a season or two) to disperse spring water on the surface until soil moisture and riparian vegetation can reach a reasonable equilibrium.
- Place straw waddles (with weed-free straw) cross slope to avoid excessive erosion and runoff, and to assist in establishing a saturation zone to promote water infiltration.
- Plant additional native riparian vegetation to promote groundwater infiltration and reduce evaporative losses and erosion.
- Place riprap on the outlet side of the culverts traversing Highway 190. Develop a vegetated swale down gradient from the culvert outlet to dissipate water energy, promote groundwater infiltration, and disperse water releases in Furnace Creek Wash.

Riparian water flow in Furnace Creek Wash would largely follow the natural channel and remnants of an historic ditch parallel to and south of Highway 190. Earthwork would occur near

Travertine Springs to create an initial flow pathway for riparian water, and downstream of the proposed Furnace Creek Wash collection gallery to strengthen an existing earthen berm that prevents riparian flows from continuing to follow the natural channel and re-crossing to the north side of Highway 190. Approximately 300 feet of open concrete channel would be installed along Highway 190 where the proximity of rock outcrops to the highway is too narrow to adequately convey riparian flows.

Affected Floodplain

Floodplain Extent

Due to diversions at Gower Gulch, the extent and volume of flood flows that reach lower Furnace Creek Wash have been reduced in comparison to pre-diversion flows. The National Park Service has estimated flood flow volumes and the extent of flooding associated with both the 100-year and maximum probable flood in Furnace Creek Wash. A 100-year flood is a flooding event which has a 1 percent chance of occurrence during any given year. The 100-year flood is a benchmark commonly used by most federal and state agencies to determine areas subject to flooding. The maximum probable flood essentially represents a worst case flooding scenario; there is no corresponding level of potential probability for such flood events during any given year. Due to the potential for flash flooding, which occurs with little or no warning, the maximum probable flood is more prominently considered than the 100-year flood event when assessing areas that may be subject to flooding inundation in Death Valley National Park.

General Flooding Characteristics

Flash floods are common to Death Valley and other desert environments where precipitation may be entirely absent except for brief, severe storm events. Flash floods occur due to several factors: heavy rainfall in a short period, a general absence of vegetation and well developed soils (which in other non-desert regions readily absorb precipitation into the ground), and steep hillsides that rapidly transmit storm water run-off downslope. These factors combine to result in flood flows that can develop within only minutes, potentially causing human injury or structural damage as the flows arrive with little or no warning.

Existing Structures in Floodplain

Components of the water collection system, specifically the Furnace Creek Wash collection lines, measurement box, and percolation trench are within the 100-year and maximum probable flood. Portions of the existing water line east of or underneath Highway 190 which conveys collected water from Travertine Springs and Furnace Creek Wash to the 2-million gallon tank are also in an area subject to flooding.

Description of Site-Specific Flood Risk

The preferred alternative is a Class 3 action with respect to the maximum probable floodplain in Furnace Creek Wash. The maximum probable flood would be partially reduced by the diversion at Gower Gulch, but flood flow elevations in the wash would be far higher than during a 100-year flood. The velocity of flood flows could destabilize the road embankment, potentially damaging Highway 190 south of Travertine Springs. Components of the water collection system, specifically the Furnace Creek Wash collection lines, measurement box, and percolation trench would be inundated by flood flows from both the 100-year and maximum probable flood.

Flood events of lesser magnitude than the 100-year flood are capable of causing significant damage in Furnace Creek Wash. This was evident during the August 2004 flash flood event. The volume of water flowing down Furnace Creek Wash exceeded the capacity of the Zabriskie Point diversion at Gower Gulch, overtopped the banks and resumed its natural course in lower Furnace Creek Wash. The August flash flood also caused severe erosion in Gower Gulch, in which gravel and sediment was transported to the Gower fan in the Death Valley salt playa.

Affected Wetlands

Wetland Location

Using the Cowardin Classification system, wetlands and deepwater habitats within the project area consist of a total of 12.243[8] acres of riverine and palustrine wetlands (see figure E-3). The National Park Service completed a wetland survey for the project area in the summer of 1999 and spring 2005 to delineate and identify Cowardin wetlands. The study area for the wetland survey included water-associated features within the Furnace Creek area, including springs located south of Texas Springs and north of Travertine Springs. A wetland delineation also was completed to describe and identify waters of the U.S. within the U.S. Army Corps Engineers' jurisdiction under Section 404 of the Clean Water Act (Environmental Science Associates 2004). The study area for the wetland delineation included water-associated features specifically at Travertine Springs, Texas Springs, and Furnace Creek Wash. Wetlands identified in the project area are regulated by the National Park Service protection policies under Executive Order 11990 and Director's Order 77-1, and may be regulated under the Porter-Cologne Water Quality Act and within the jurisdiction of the Lahontan Regional Water Quality Control Board. These wetlands are not regulated under Sections 401 and 404 of the Clean Water Act (USACOE 2005).[9]

Wetland Characteristics

Biotic Value

Wetlands within the project area are broadly classified as riparian in nature and include aquatic, riparian, and emergent communities. Specific wetland classes identified within the project area are limited to the following (see figures E-4 (Travertine Springs), E-5 (Furnace Creek Wash), E-6 and E-7 (Springs between Texas Springs and Travertine Springs), E-8 (Texas Springs East), E-9 (Texas Spring West), and E-10 (Texas Springs North):

- *Riverine intermittent streambed* - occurs along the downstream portion of Furnace Creek Wash and Texas Springs. It is a seasonally or intermittently flooded rock-, cobble-, or sand-

8 The number of acres of wetlands are based on field observations and were calculated using ArcMap 9.1 Geographic Information Systems. Three significant digits were used to distinguish the impacts between the alternatives, and are typical when working with the wetland permitting agencies (U.S. Army Corps of Engineers and Regional Water Quality Control Board) to determine the appropriate wetland permits.

9 The U.S. Army Corps of Engineers has determined that the wetlands in the Furnace Creek area are not within the U.S. Army Corps of Engineers' jurisdiction because they do not normally flow to the Badwater Basin, which is connected to the Amargosa River, an interstate water of the U.S.

bottom channel with little to no in-stream vegetation. Riverine intermittent streambed totals 0.149 acres within the project area.

- *Riverine upper perennial* - occurs at Furnace Creek Wash, Travertine Springs, and Texas Springs. It is characterized by a high gradient and fast water velocity. Some water flows throughout the year and substrate consists of rock, cobbles, or gravel with occasional patches of silt. There is very little floodplain development. Riverine upper perennial totals 0.437 acres within the project area.
- *Palustrine scrub-shrub* – occurs at Travertine Springs, Texas Springs and springs between Travertine Springs and Texas Springs. Palustrine scrub-shrub consists of primarily perennial woody plants that occur near the toe of the bank of washes and springs. Because of the presence of the perennial water source, several woody species have become established in these areas. The dominant species in palustrine scrub-shrub include arrow-weed (a facultative wet species) and screwbean mesquite (a facultative species). Several non-native woody species, including date palm (*Phoenix dactylifera*) and saltcedar (*Tamarix ramosissima*), also occur in palustrine scrub-shrub habitat. Palustrine scrub-shrub can be saturated, temporarily flooded or seasonally flooded. Palustrine scrub-shrub totals 4.334 acres within the project area.
- *Palustrine emergent* – occurs at Travertine Springs, Texas Springs, springs between Travertine Springs and Texas Springs, and Furnace Creek Wash. Palustrine emergent saturated habitat consists of mainly perennial herbaceous plants that typically occur in saturated soils associated with streams, washes or springs. The dominant species in this wetland habitat include, but are not limited to, cattail (an obligate species), American bulrush (an obligate species), Cooper's rush (an obligate species) and southern goldenrod (a facultative species). Palustrine emergent saturated habitat includes alkaline habitats, such as the saltgrass meadow.

  Saltgrass meadows occur where the soil contains silt and salt, and retains moisture moderately well. Saltgrass draws from where soil moisture is near the surface. Palustrine emergent totals 7.313 acres within the project area.
- *Palustrine aquatic bed* – occurs at the downstream end of Furnace Creek Wash within the project area. It is an open water pool with plants growing on or below the surface of the water for most of the growing season in most years. The dominant species in this wetland is starwort (*Callitriche* sp.). Palustrine aquatic bed totals 0.010 acres within the project area.

Table E-1 provides a summary of wetlands in the Furnace Creek Wash, Travertine Springs, and Texas Springs areas. Figures E-3 through E-10 generally group spring occurrences based on the location of the wetland features, while the acreages in Table E-1 more precisely define the boundaries of each spring complex. Travertine Springs includes those wetlands east of Highway 190. Furnace Creek Wash includes those wetlands west of Highway 190. Texas Springs includes those wetlands in the northern portion of the project area. The remaining springs are south of Texas Springs and north of Travertine Springs.

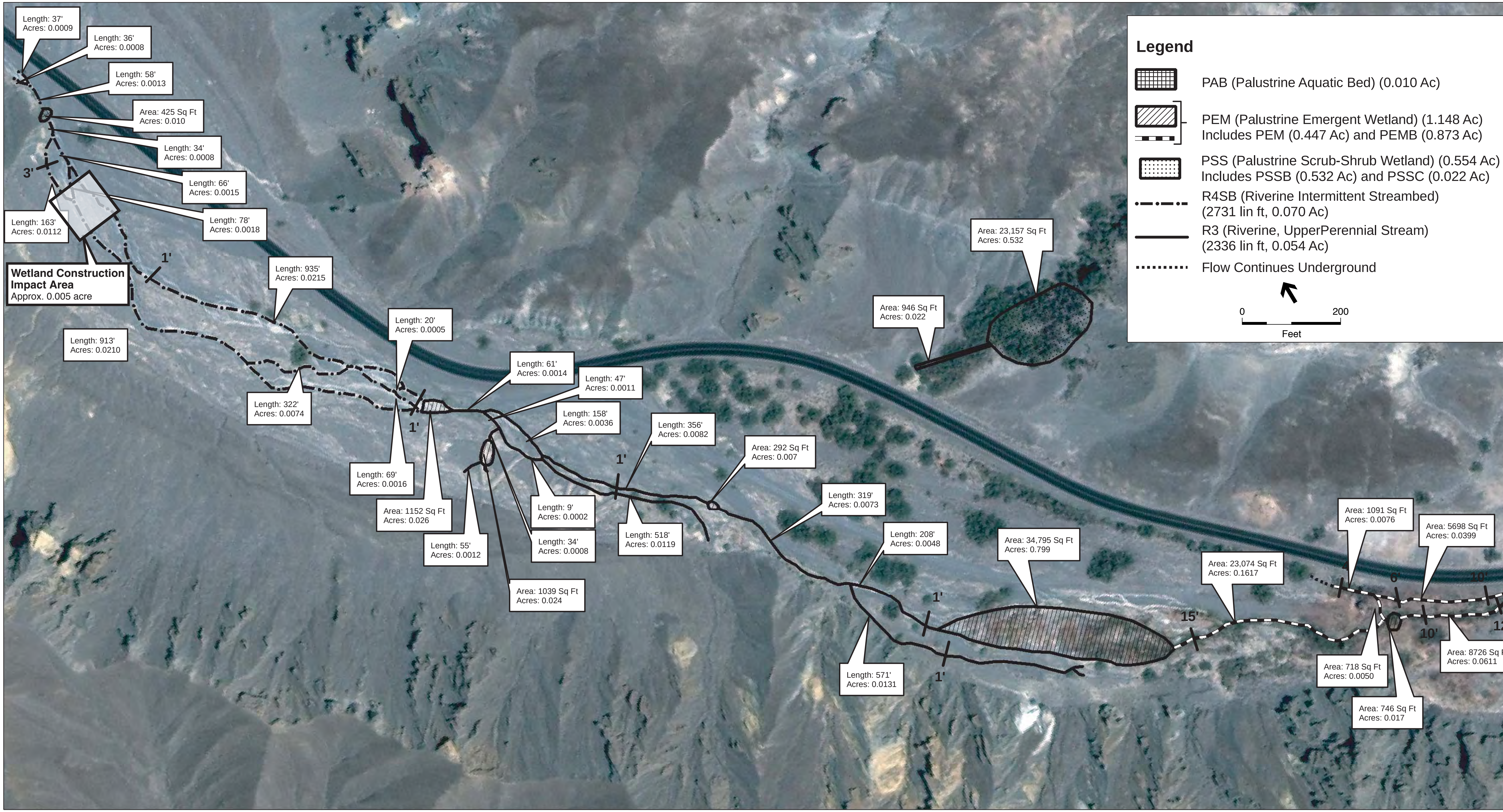
Figure E-3
Furnace Creek Wetland Index: Texas Springs, Furnace Creek Wash, Travertine Springs

Figure E-4
Wetland Impact Areas: Travertine Springs

NOTE: Existing wetland acreages are shown. The Preferred Alternative would reduce the wetland acreages by approximately 24%.

SOURCE: Environmental Science Associates and National Park Service

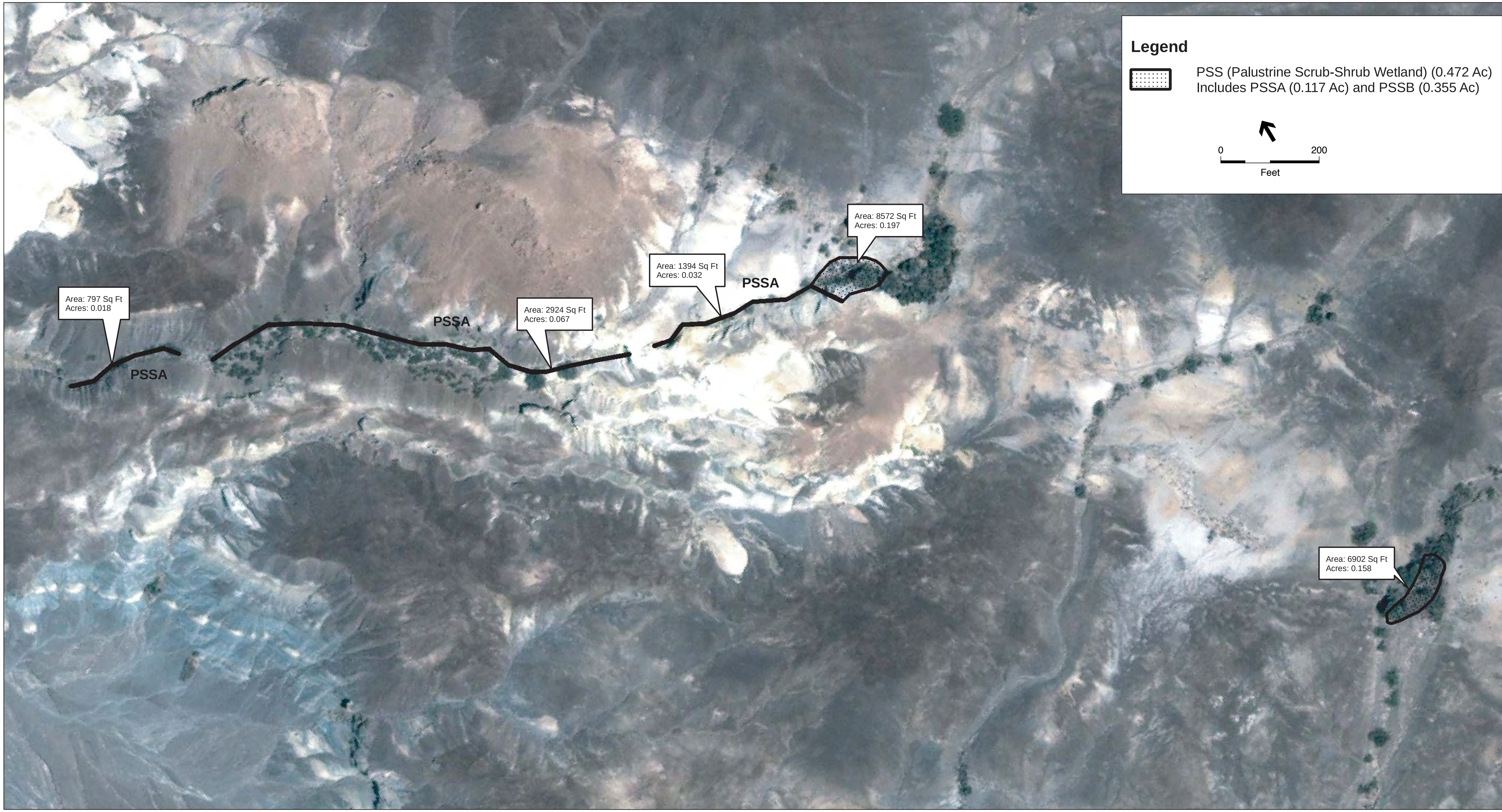
Figure E-5
Wetland Impact Areas: Furnace Creek Wash



NOTE: Existing wetland acreages are shown. The Preferred Alternative would reduce the wetland acreages by approximately 24%.

SOURCE: Environmental Science Associates and National Park Service

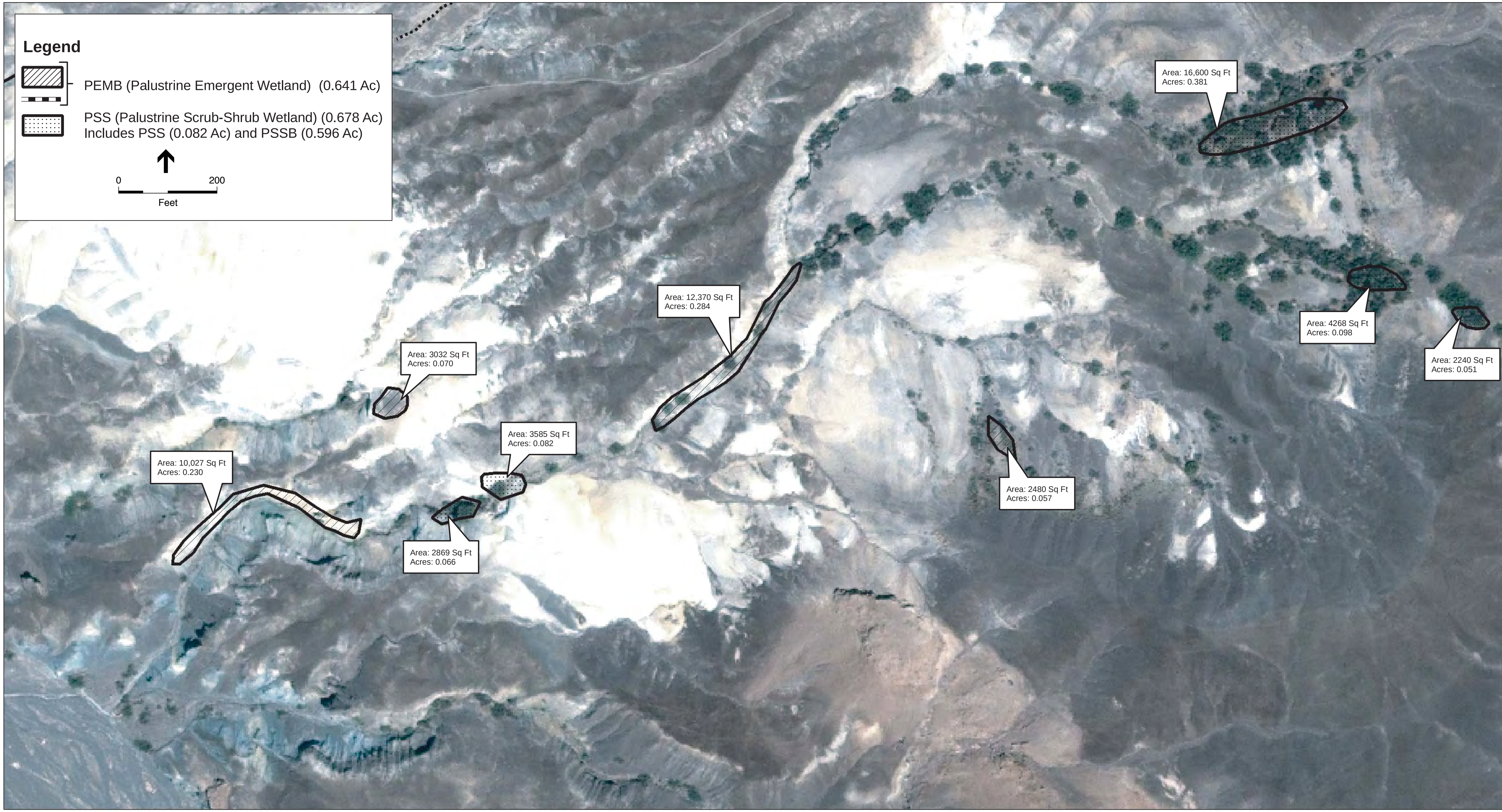
Figure E-6
Wetland Impact Areas: Springs between Texas Springs and Travertine Springs



NOTE: Existing wetland acreages are shown. The Preferred Alternative would reduce the wetland acreages by approximately 24%.

SOURCE: Environmental Science Associates and National Park Service

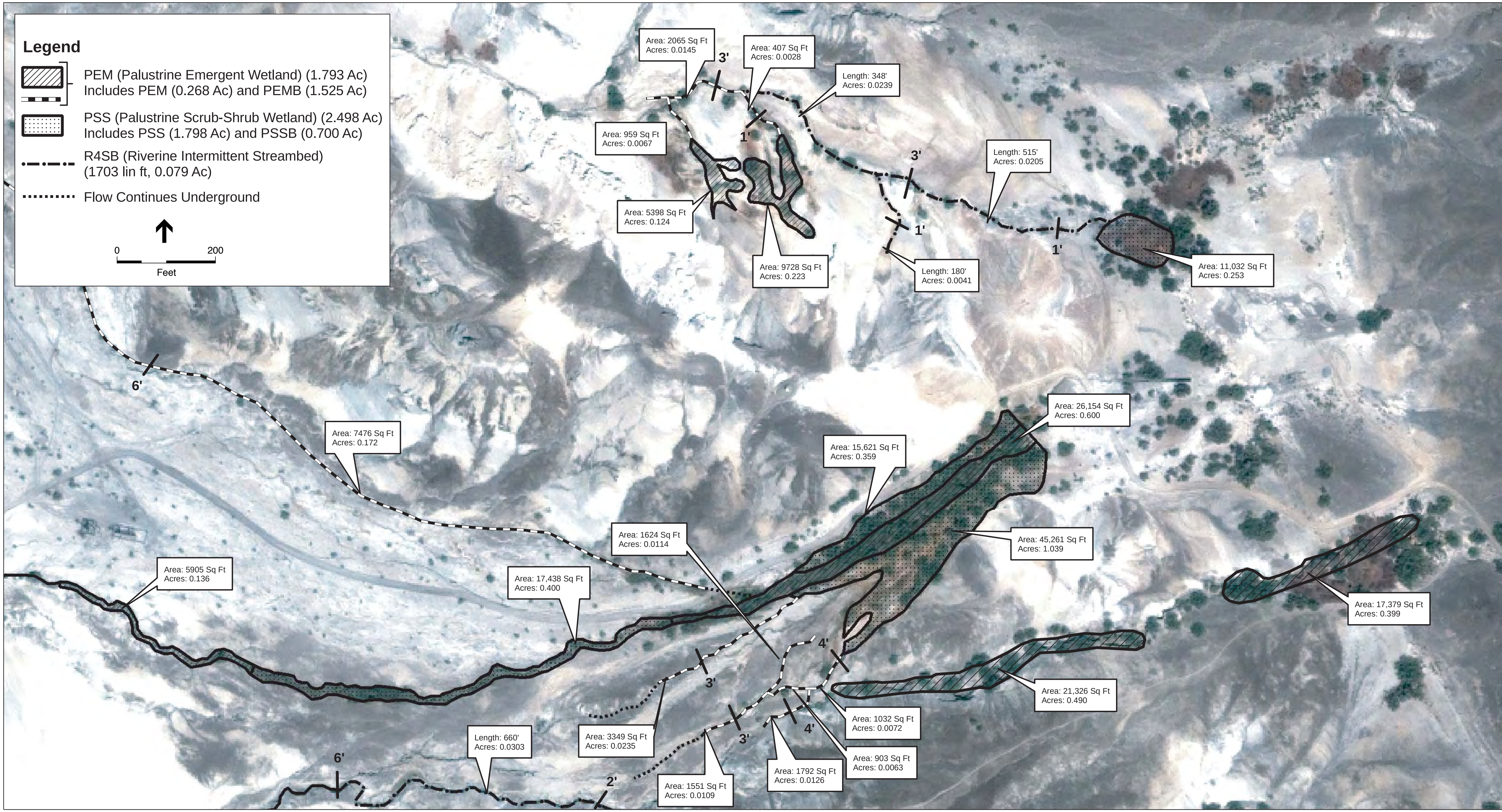
Figure E-7
Wetland Impact Areas: Springs between Texas Springs and Travertine Springs



NOTE: Existing wetland acreages are shown. The Preferred Alternative would reduce the wetland acreages by approximately 24%.

SOURCE: Environmental Science Associates and National Park Service

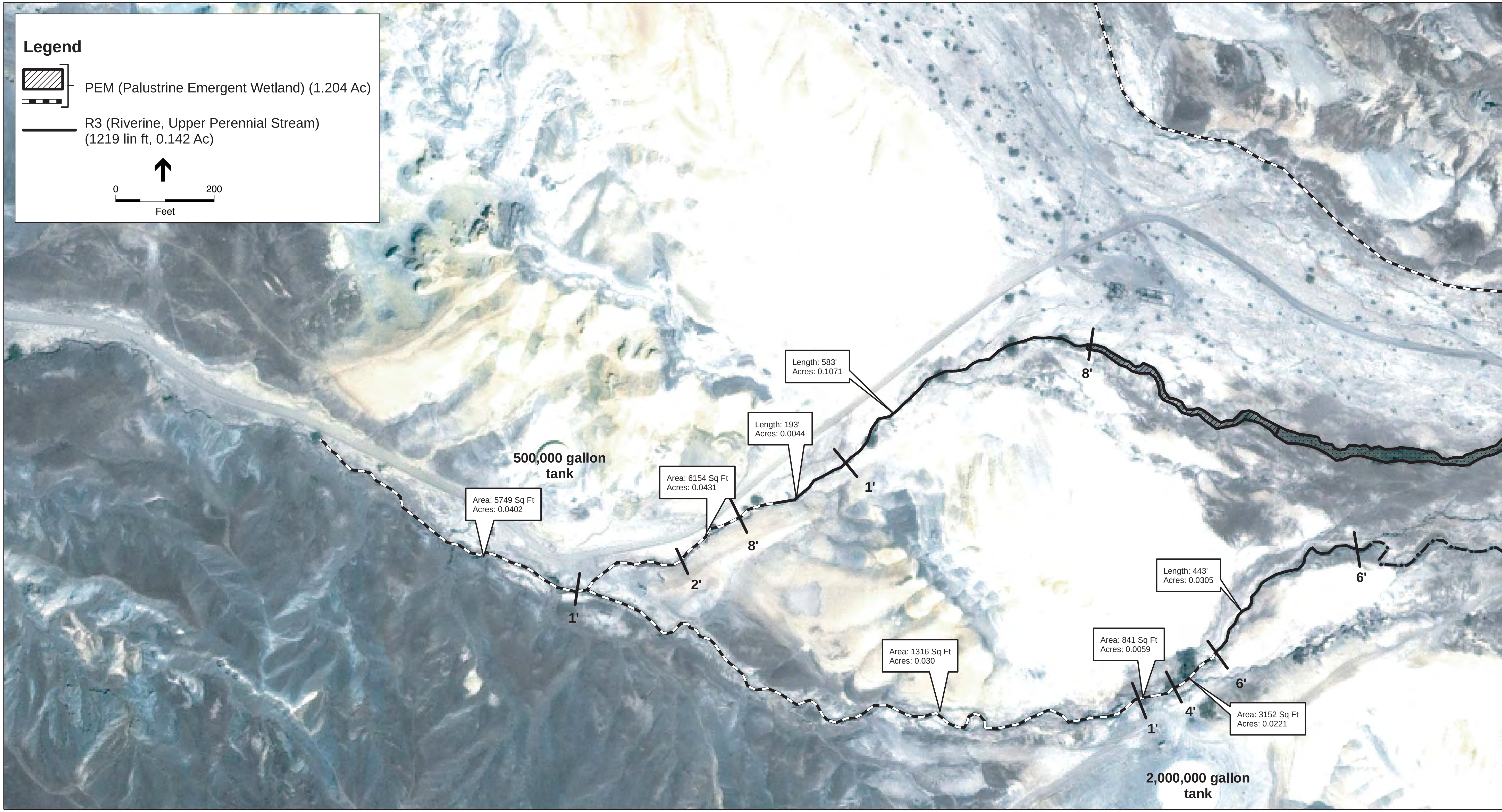
Figure E-8
Wetland Impact Areas: Texas Springs East



NOTE: Existing wetland acreages are shown. The Preferred Alternative would reduce the wetland acreages by approximately 24%.

SOURCE: Environmental Science Associates and National Park Service

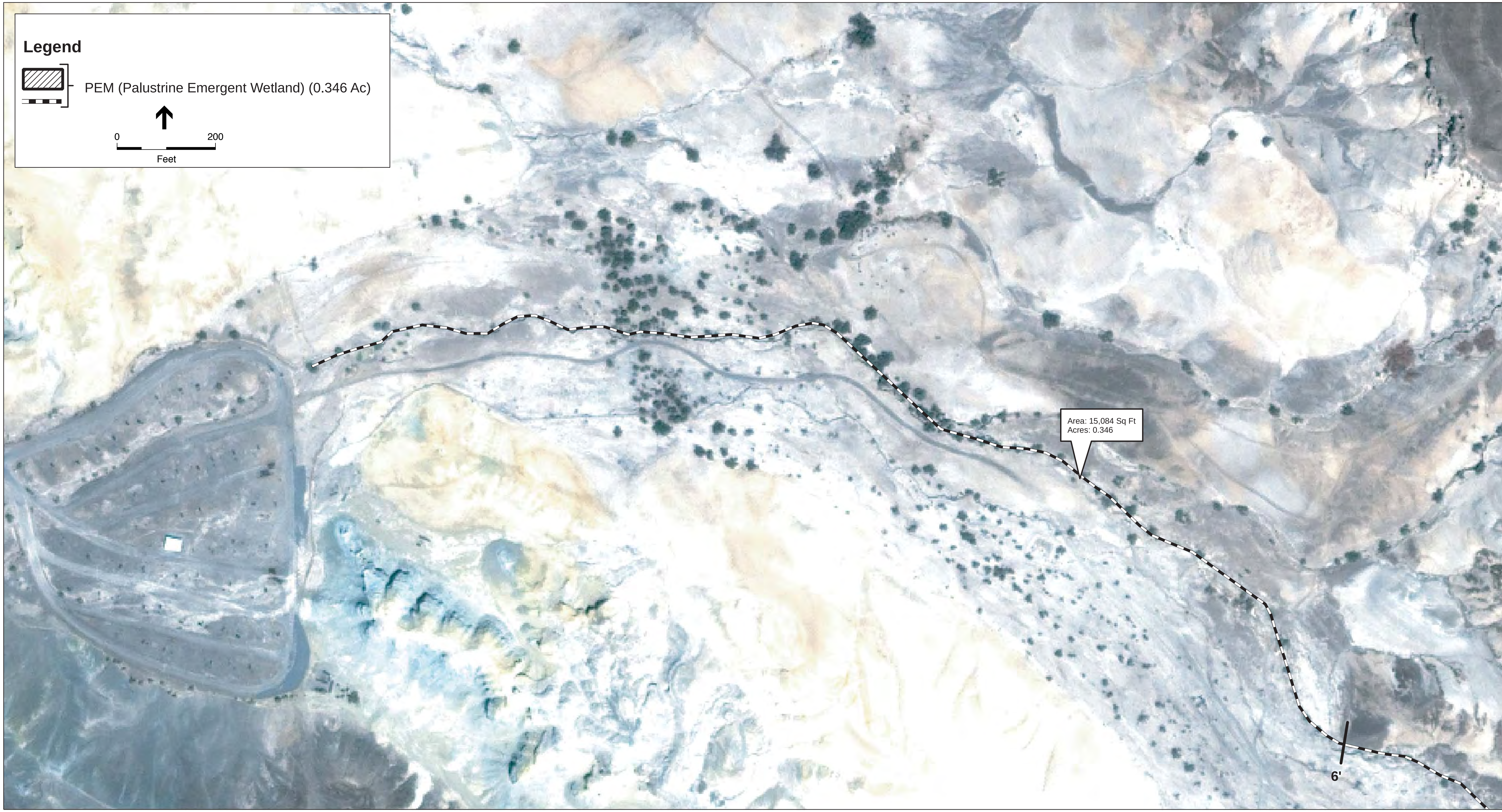
Figure E-9
Wetland Impact Areas: Texas Springs West



NOTE: Existing wetland acreages are shown. The Preferred Alternative would reduce the wetland acreages by approximately 24%.

SOURCE: Environmental Science Associates and National Park Service

Figure E-10
Wetland Impact Areas: Texas Springs North



NOTE: Existing wetland acreages are shown. The Preferred Alternative would reduce the wetland acreages by approximately 24%.

SOURCE: Environmental Science Associates and National Park Service

TABLE E-1
General Description of Wetland Habitats in the Furnace Creek Area

Cowardin Classification Category	Occurrence	Area (acres)
Riverine Wetlands		
Riverine Upper Perennial	▪ Furnace Creek Wash ▪ Travertine Springs ▪ Texas Springs	▪ 0.054 ▪ 0.241 ▪ 0.142
Riverine Intermittent Streambed	▪ Furnace Creek Wash ▪ Texas Springs	▪ 0.070 ▪ 0.079
Palustrine Wetlands		
Palustrine Scrub-shrub (saturated, temporarily flooded, seasonally flooded)	▪ Travertine Springs ▪ Texas Springs ▪ Springs located south of Texas Springs and north of Travertine Springs	▪ 0.132 ▪ 2.498 ▪ 1.704
Palustrine Emergent (saturated)	▪ Furnace Creek Wash ▪ Travertine Springs ▪ Texas Springs ▪ Springs located south of Texas Springs and north of Travertine Springs	▪ 1.320 ▪ 2.009 ▪ 3.343 ▪ 0.641
Palustrine Aquatic Bed	▪ Furnace Creek Wash	▪ 0.010

Vegetation

Plant communities are assemblages of plant species that occur together in the same area, which are defined by species composition and relative abundance. Vegetation within the Furnace Creek project area were classified using A Manual of California Vegetation (Sawyer and Keeler-Wolf 1995) and were based on field observations conducted in May 2004. The project area contains wetland and upland plant series (communities). Wetland plant series include saltgrass, cattail, arrowweed, mixed stands, tamarisk, and mesquite. Upland plant series include creosote bush and desert-holly.

The August 2004 flash flood event significantly affected wetland vegetation in Furnace Creek Wash and honey mesquite vegetation primarily along the edge of Highway 190. Much of the vegetation was removed from Furnace Creek Wash or severely damaged. A description of wetland plant series only follows.

Saltgrass Series. This series occurs in areas where the soil contains silt and salt, and retains moisture moderately well. Saltgrass (*Distichlis spicata*) is the dominant plant in seeps and draws where soil moisture is near the surface. This series can also dominate areas that do not exhibit saturated conditions. Associate species in this community can include Cooper's juncus and alkali sacaton.

Cattail Series. Cattail series occurs in permanently, regularly, semipermanently, seasonally, and irregularly flooded habitat conditions. Cattails (*Typha* spp.) can form pure stands, but can mix with other species, including bulrushes, yerba mansa, rushes, and saltgrass.

Arrowweed Series. This community occurs in seasonally flooded, saturated habitat conditions. Arrowweed (*Pluchea sericea*) often forms pure stands. This species can also occur as a dominant shrub mixed with cattails, desert baccharis (*Baccharis sergiloides*), rushes (*Juncus* spp.), and screwbean mesquite (*Prosopis pubescens*).

Mixed Stands. This community is composed of wetland species that occur along washes. Co-dominant species include screwbean, saltgrass, spikerush (*Eleocharis* sp.), desert baccharis, Cooper's rush (*Juncus cooperi*), arrowweed, American bulrush (*Scirpus americanus*), goldenrod (*Solidago confinis*), alkali sacaton (*Sporobolus airoides*), yerba mansa (*Anemopsis californica*), and cattails.

Tamarisk Series. Tamarisk series occurs in intermittently flooded, saturated habitats. Athel tree (*Tamarix aphylla*) and saltcedar (*Tamarix ramossissim*a), both referred to as tamarisk, occur as sole species or as dominant plants mixed with other species. Tamarisks are salt-tolerant species. Associated species typically occurring with tamarisks include willows (*Salix* spp.) and date palm (*Phoenix dactylifera*). Tamarisks are invasive, non-native species that can spread in most wetlands. As part of the National Park Service on-going restoration efforts, tamarisks are routinely removed from natural areas.

Mesquite Series. A forest of mesquite is referred to as a "mesquite bosque" and is important riparian habitat. Mesquite bosques are found in intermittently flooded or saturated soils, floodplains, fringes of playas, streambanks, in and around springs, washes, and at the base of alluvial fans. Honey mesquite (*Prosopis glandulosa*) grows on the upland edge of wetland areas, where the water is shallow and salinity levels are low. Screwbean tends to occur in areas of higher moisture, such as at Travertine Springs. Both honey mesquite and screwbean occur as the sole species or as dominant trees (or shrubs).

Wildlife

Death Valley National Park and the adjacent desert support a variety of wildlife species. The extreme heat and aridity near the floor of Death Valley generally precludes high vertebrate diversity. The exception to this generalization occurs in the vicinity of habitats that possess surface water. Wetland and riparian habitats in the desert and within the park are frequently inhabited by animals that can not survive in arid and less vegetated environments.

The most obvious water dependent species in Death Valley include local fish, the amphibian fauna (frogs and toads), several bird species, and numerous aquatic invertebrates (insects and mollusks). Many of these animals occur in habitats that are small, and are therefore vulnerable to natural events, such as such as the major flood that occurred in the project area in August 2004, as well as anthropogenic disturbances such as surface water diversions.

Relatively common wildlife species in the Furnace Creek area include a number of small rodents such as woodrat, mice, kangaroo rats, and jackrabbits. A variety of common bat species, such as western pipistrelles (*Pipistrellus hesperus*), are likely to occur in the project area. The most common large mammal in the vicinity of the project area is the coyote. Bighorn sheep historically were known to water in the Travertine Springs area, but the presence of these animals is rare today.

Common bird species include the common raven, Say's phoebe, house sparrow, and Brewer's blackbird. The documented bird fauna in the Furnace Creek Wash – Travertine Springs area includes relatively low numbers of other bird species and it is thought that the low bird diversity is a function of the alteration of the extent and structure of the local vegetation community that has occurred as a result of local water diversion activities. The majority of bird species found within the project area do not reside in the area on a year-round basis. Those that do tend to rely heavily on the availability of local surface water for drinking and bathing purposes during the summer months.

Several lizard species are likely to occur in the project area including the side-blotched lizard, desert banded gecko, and zebra-tailed lizard. Given the presence of local wetlands, it is expected that the following species may also be present: Great Basin whiptail, coachwhip, Mojave shovel-nosed snake, Panamint rattlesnake, and Mojave Desert sidewinder.

The only native amphibian population in the Furnace Creek area is made up of red-spotted toads, which are present in Furnace Creek Wash and the small stream habitats below Travertine and Texas Springs. Introduced populations of bullfrogs and western toads are present at Furnace Creek Ranch, while native toads appear to absent from this area.

Mosquitofish are the only fish that inhabit aquatic habitat within the project area. This species is not desirable within the project area, since mosquitofish is not locally native and are known to consume amphibian larvae.

Exotic wildlife species of primary concern within the project area include red-rimmed oriental snails, Louisiana crayfish, mosquito fish (discussed above), and bull frogs. These exotic species have been documented to result in adverse impacts to native habitats and fauna.

Special-status Species

Special-status wildlife species that are known to occur, potentially occur, or have historically occurred in aquatic or terrestrial habitat associated with the Furnace Creek area and are considered in this evaluation include the following:

- *Invertebrates* – Nevares Spring naucorid bug, Badwater snail, Robust Ipnobius springsnail, Texas Springs amphipod, Travertine Springs amphipod, Furnace Creek riffle beetle, western riffle beetle, and three species of as yet undescribed ostracods (*Candona* sp.)
- *Amphibians* – red-spotted toad
- *Birds* – western least bittern, white-faced ibis, northern harrier, sharp-shinned hawk, Cooper's hawk, northern goshawk, Swainson's hawk, ferruginous hawk, golden eagle, osprey, merlin, prairie falcon, mountain plover, long-billed curlew, western yellow-billed cuckoo, long-eared owl, short-eared owl, burrowing owl, willow flycatcher, Southwestern willow flycatcher, vermillion flycatcher, brown-crested flycatcher, loggerhead shrike, gray vireo, least Bell's vireo, horned lark, bank swallow, Bendire's thrasher, Crissal thrasher, Le Conte's thrasher, yellow warbler, Virginia's warbler, yellow-breasted chat, summer tanager, tricolored blackbird.
- *Mammals* – American badger, Townsend's western big-eared bat, Small-footed myotis bat, Fringed myotis bat, Pallid bat.

Thirteen special-status plant species known or likely to occur in the sandy soils of the Furnace Creek Wash floodplain or in the mesic, alkaline areas associated with Texas and Travertine Springs include:

Regionally Rare Species (CNPS List 1 and 2)

- Reveal's buckwheat
- Robust Hoffman's buckwheat
- Hot-springs fimbristylis
- Death Valley golden carpet
- Death Valley sandpaper plant
- Black sedge
- Death Valley blue-eyed grass
- Knotted rush

Regionally Rare Species (CNPS List 4)

- Ribbed cryptantha
- Winged cryptantha
- Copperwort
- Cooper's rush
- Death Valley sage

Scenic Values

In general, wetlands are considered aesthetically-pleasing natural features. The floor of Death Valley is characterized by earth and sand strewn with cobbles, gradually transforming into the white-crusted salt playa toward the center of the valley. Vegetation in the Furnace Creek area clearly demarcates the riparian areas. Travertine and Texas Springs and Furnace Creek Wash are highly visible vegetated riparian areas in an otherwise dry, stark landscape along Highway 190. The springs between Travertine and Texas Springs are less visible because of their small size. Although the riparian habitats created by Furnace Creek Wash and the Springs are not commonly a scenic destination for park visitors, the visual contrast they provide to the surrounding desert landscape is an important component to the scenic character of the Furnace Creek area.

Recreation Values

The Furnace Creek area is the most visited location in Death Valley National Park and includes a wide range of recreational opportunities, including camping, day hiking, picnicking, sightseeing, horseback riding, bicycling, and golfing. Although the springs and Furnace Creek Wash are inaccessible for several of these activities, the area is accessible by horse trails.

Cultural Values

Numerous archeological sites are located within the Furnace Creek area. Fifty-four prehistoric, ethnographic, and historical sites are known to exist within a one-mile buffer of the Texas Spring, Travertine Springs and Furnace Creek Wash area of the park. This area continues to be culturally valuable due to its importance as a gathering area for traditional plants used by the Timbisha Shoshone Tribe. Culturally important plants are used as food, medicines, and in traditional tools such as basketry.

In addition, among the many Civilian Conservation Corps projects in Death Valley were the installation of new piping, a catchment basin, and a holding tank at Texas Springs, as well as a pipeline delivering water from Texas Springs to Furnace Creek. The stonework lining at the entrance of the Texas Springs tunnel may also have been built by the Civilian Conservation Corps.

Socioeconomic Values

Revenue generating facilities operated by the National Park Service in Furnace Creek, including the park headquarters, visitor center, a fee collection station, a museum, and three campgrounds, receive their water supply from the Furnace Creek water system. In addition, the Timbisha Shoshone Tribe, with 50 residents in the Furnace Creek area, also relies on water from the Furnace Creek water system. The Tribe is planning to construct facilities on its Furnace Creek property for purposes of community and residential development, economic development, and infrastructure improvement. Finally, Xanterra's facilities, including the Furnace Creek Inn and Ranch, as well as an 18-hole golf course, swimming pools, tennis courts, ranch stables, museum, general store, and restaurants also receive their water supply from the Furnace Creek water system. Xanterra's employees primarily live in Xanterra's facilities at Furnace Creek and receive residential water from the Furnace Creek water system.

Existing Structures in Wetlands

Existing structures in wetlands include components of the water collection system, specifically the Travertine Springs Line 1 collection gallery, the Travertine Springs measurement box, and the Furnace Creek Wash collection lines and percolation trench.

Environmental Consequences of the Preferred Alternative on Wetland and Floodplains

Effects on Floodplain

Overall, the preferred alternative would result in a local, long-term, negligible, beneficial impact. Water collection and conveyance facilities in Furnace Creek Wash may continue to be damaged by flood flows, necessitating potential repair by the National Park Service; however, the proposed water conveyance line and collection gallery in the wash would include subsurface features that would not affect flood flows.

Effects of Flooding

Under the preferred alternative, perennial flows from Travertine Springs would be conveyed underneath Highway 190 and Badwater Road via 4 newly installed culverts. A new collection line and measurement box would be installed in Furnace Creek Wash, and the existing measurement box would be removed. A percolation trench would be installed in Furnace Creek Wash for concentrate water discharge. The removal and reinstallation of the measurement box in Furnace Creek Wash, and installation of a percolation trench would not result in a discernible change in susceptibility to flooding. The new measurement box would slightly reduce potential damage to the water collection system from flood flows as it would be installed below the surface of the wash; however, flood flows could still erode overlying deposits and cause damage. Potential flooding impacts associated with the preferred alternative would be considered negligible and beneficial to Furnace Creek Wash.

Effects on Wetlands

Overall, the preferred alternative would have a local, long-term, major, beneficial impact on wetlands. The beneficial effects of discontinuing water diversions at Travertine Springs and Texas Springs under this alternative and re-establishing riparian habitat in Furnace Creek Wash would outweigh the adverse construction-related and operation-related impacts. The project would result in a net gain of wetland habitat in the Furnace Creek area.

Construction-related Effects on Wetlands

Construction-related impacts related to wetlands under the preferred alternative would result in a local, short-term, minor, adverse impact.

Activities under the preferred alternative would affect a total of approximately 0.013 acres of wetlands (see Table E-2), including approximately 0.008 acres of palustrine emergent (see figure E-4) and approximately 0.005 acres of riverine intermittent streambed (see figure E-5). Activities would involve constructing three culverts under Highway 190 downslope of Travertine Springs

TABLE E-2
Areas of Affected Wetland Habitat in the Furnace Creek Area Due to Construction and Operational Effects

Cowardin Classification Category	Operation Effects Based on 24% Reduction (Acres)	Construction Effects (Acres)
Travertine Springs (Fine Soil Types)		
Riverine Upper Perennial	0.06	--
Palustrine Scrub-shrub (saturated, temporarily flooded, seasonally flooded)	0.03	--
Palustrine Emergent (saturated)	0.50	0.008
Texas Springs (Fine Soil Types)		
Riverine Upper Perennial	0.03	--
Riverine Intermittent Streambed	0.02	--
Palustrine Scrub-shrub (saturated, temporarily flooded, seasonally flooded)	0.60	--
Palustrine Emergent (saturated)	0.80	--
Furnace Creek Wash and Fan (Coarse Soil Types)		
Riverine Lower Perennial	--	--
Riverine Upper Perennial	0.01	
Riverine Intermittent Streambed	0.02	.005
Palustrine Scrub-shrub (saturated, temporarily flooded, seasonally flooded)	--	--
Palustrine Emergent (saturated)	0.32	--
Palustrine Aquatic Bed	.002	--
Springs between Texas Springs and Travertine Springs (Fine Soil)		
Palustrine Scrub-shrub (saturated, temporarily flooded, seasonally flooded)	0.41	--
Palustrine Emergent (saturated)	0.15	--

Lines 1 and 2 potentially within approximately 0.008 acres of palustrine emergent wetland habitat (see figure E-4), improving an abandoned road for accessing a groundwater monitoring well across a riverine intermittent stream, and installing a new collection gallery adjacent to riverine intermittent streambed in Furnace Creek Wash. The culverts would be installed using open trench construction techniques, although the entrance and exit portals may be located within palustrine emergent wetlands. Improvements to an abandoned road for a groundwater monitoring well (see Chapter II, Alternatives, figure II-6) may involve a small amount of erosion in the dry stream during improvement activities, such as grading, which would result in negligible to minor impacts on the stream. Installation of the new collection gallery would require trenching activities and crossing wetlands with heavy equipment, as well as temporary disturbance to approximately 0.005 acres of riverine intermittent streambed due to installing the Furnace Creek Wash collection gallery (see figure E-5). A 36-inch culvert would be installed at Badwater Road to convey surface flows to Furnace Creek Fan outside of existing wetlands.

The proposed pipeline for the groundwater production wells would potentially cross a riverine intermittent streambed in the Texas Springs area near its convergence with an existing potable water line, which would convey water to the reverse osmosis water treatment plant. Because Alternative 3 generally defines the location of the proposed pipeline alignment, the placement of the pipeline could avoid this riverine intermittent streambed through appropriate site design. Trenching for installation of approximately 800 linear feet of nonpotable pipeline and construction of a 20-foot by 200-foot percolation trench for the discharge of concentrate water would occur north of the former alignment of Furnace Creek Wash. This portion of the wash is currently dry and no longer functions as a stream except during high flood events. No construction-related effects to wetlands are anticipated along the proposed nonpotable pipeline or percolation trench in Furnace Creek Wash.

Additionally, wetlands may be exposed temporarily to minimal trampling and erosion during construction for the culverts and collection gallery, as well as removal of the Furnace Creek Wash measurement box and capping the water lines in Furnace Creek Wash.

To reduce the intensity of adverse construction-related impacts on wetlands due to culvert installation, the National Park Service would install riprap at the outlet of the new culverts to reduce the flow velocity and provide erosion control, and appropriately sized culverts would be used to accommodate riparian water flows.

As identified in Appendix D, Mitigation Measures Common to All Action Alternatives, the National Park Service would implement Best Management Practices and mitigation measures (including, but not limited to, avoiding wetlands to the maximum extent feasible utilization of wetland protection measures such as installing protective fencing material to confine construction activities, using silt fencing to reduce erosion as necessary, working in perennial wetlands during the low-flow season, and restoring wetland and riparian habitats at a minimum 1:1 ratio as described in the Proposed Compensation section) to protect wetlands during construction activities and minimize erosion during construction activities. Thus, the intensity of the effects on wetlands would be minor.

Operation-related Effects on Wetlands

Operation-related impacts related to wetlands under the preferred alternative would result in a local, long-term, major, beneficial impact.

Alternative 3 would greatly improve wetlands and increase habitat for wildlife species, and improve connectivity of surface flows from the springs to Furnace Creek Wash. Connectivity of surface flows to the alluvial fan and mesquite bosque would be slightly improved. Although the flow discharge could vary during average water demands, the effect on wetlands would be greatly beneficial in the long-term compared to Alternative 1.

Under Alternative 3, a total of 770 gpm would be allocated for riparian and associated wetland uses (see Chapter II, Alternatives, table II-1. Compared to Alternative 1, during average and maximum daily flow requirements, the discharge from all springs under Alternative 3 would potentially reduce by approximately 24% because of groundwater pumping from two to three groundwater production wells and associated average potable water demand up to 429 gpm during average daily flow requirements and 600 gpm during maximum daily flow requirements. Maximum water demands would be brief, only occurring about 20 days which would spread over the year, thus, no measurable difference in discharge are anticipated to occur in riparian areas compared to average water demands (see Chapter II, Alternatives, Elements Common to All Alternatives). Due to the underlying hydrology of the area, effects of the flow reduction due to groundwater pumping would likely spread equally among discharge points as well as among springs where no diversion activities occur in the Furnace Creek area. Therefore, the extent of existing wetlands would potentially reduce accordingly by approximately 24%, or approximately 3 acres[10] (see Table E-2). As a result of the wetland reduction due to groundwater pumping, wetland species composition may change from species requiring saturated conditions to species that can tolerate both saturated and moist upland conditions, particularly at small palustrine wetlands such as those located between Texas Springs and Travertine Springs.

Nonetheless, implementation of Alternative 3 would result in an approximately 130% (435 gpm more than 335 gpm under Alternative 1) increase in water released for riparian and associated wetland flow, primarily from Travertine Springs Lines 2, 3 and 4 (515 gpm), which is the largest spring system in the project area. Compared to Alternative 1, these flow rates would represent an increase in riparian discharges at Travertine Springs Line 2, 3, and 4 under the preferred alternative. Groundwater recharge to Furnace Creek Wash at the Inn Tunnel would be discontinued; however, on average, 86 gpm of diluted concentrate water would be discharged for groundwater recharge and somewhat offset the loss of groundwater recharge from the Inn Tunnel. Furthermore, increased riparian releases at Travertine Springs Lines 2, 3 and 4 would augment flows downgradient.

Flows would re-establish formerly dry wetlands primarily in the Travertine Springs area, such as the historic dry wetland downgradient of Travertine Springs Line 2 (see figures E-4 and II-5), and would greatly benefit wetlands in the Furnace Creek area in the long-term. Alternative 3 would greatly improve wetlands and increase habitat for wildlife species, and improve connectivity of surface flows from the springs to Furnace Creek Wash. It is anticipated that Alternative 3 would restore approximately 60 acres of palustrine and riverine wetlands in the Furnace Creek area (see Proposed Compensation below). Connectivity of surface flows to the alluvial fan and mesquite bosque would be slightly improved. The flow discharge could vary during average water demands, however, the effect on wetlands would remain beneficial in the long-term compared to

[10] The exact number of acres of wetland loss due to groundwater pumping is unknown. The loss of wetlands would depend on topography, slope, channel incision, plant species evaporation rates, and other geomorphic, physiological and environmental factors. For the purposes of this document, it is assumed that the loss of wetlands would directly correlate with the spring flow reduction at a 1:1 ratio.

Alternative 1. Although the flow and size of springs between Texas and Travertine Springs would be reduced by approximately 24% following project implementation, the increased connectivity and size of wetlands, primarily at Travertine Springs and Furnace Creek Wash, would greatly benefit wetlands and outweigh the adverse groundwater pumping effects associated with the springs between Texas and Travertine Springs.

Increased discharges from springs for riparian and associated wetland allocation in the project area would restore historically dry wetlands in Travertine Springs and Texas Springs, and thereby, increase the size of wetland vegetation and improve continuity of plant communities. Re-establishing riparian habitat in the project area would increase nutrients, organic matter, and shade. Increased discharges from springs would improve plant community dynamics, including plant species diversity and richness. New or increased surface flows for riparian allocation would encourage development of a riparian forest community as well as shrub and emergent wetland vegetation. Stream banks also would become more defined as scouring occurs along watercourses. As riparian and associated wetland vegetation establishes within springs, the potential for erosion would decrease. Consequently, increased discharges also would encourage the spread of non-native invasive plant species, including date palm, California fan palm, and tamarisk. Tamarisk would be removed as part of the on-going tamarisk eradication program. Other invasive plant species, such as palms, could displace and reduce the diversity of native plant species, which would result in a moderate, adverse effect. As identified in Appendix D, Mitigation Measures Common to All Action Alternatives, the National Park Service would implement Best Management Practices and mitigation measures (e.g., implementing a non-native invasive species program, a natural resource program and a revegetation program), which would reduce the moderate, adverse impact of invasive plant species to minor.

Discharge of concentrate water from the reverse osmosis water treatment plant into a percolation trench for groundwater recharge would not result in effects to wetlands since the proposed percolation trench is located in an area of Furnace Creek Wash that no longer functions as a stream, except during high flood events. The elevated constituent levels in the concentrate water would be attenuated through groundwater dilution as it moves through the groundwater flow system. Thus, no effects to wetlands due to the release of concentrate water in the groundwater are anticipated.

The relocation of the Furnace Creek Wash collection gallery would result in the re-establishment and restoration of wetlands in Furnace Creek Wash. Re-establishing riparian and associated wetland habitat in Furnace Creek Wash would increase nutrients, organic matter, and shade. Additionally, implementation of riparian water releases (see Elements Common to All Action Alternatives above) would reduce erosion associated with releasing water into natural areas. With implementation of mitigation measures, aquatic wildlife species would be monitored due to the groundwater pumping activities. Monitoring of aquatic species would assist in determining the efficacy of flows to the springs, and subsequently, the health of the wetland system. Overall, Alternative 3 would have a local, long-term, major, beneficial effect on wetlands.

Effects on Common Riparian and Wetland-dependent Wildlife Species

Overall, the proposed action would result in a local, long-term, major, beneficial impact on common riparian and wetland-dependent wildlife (see Chapter IV, Environmental Consequences, Alternative 3, Wildlife for a further description of impacts on Wildlife).

Construction-related activities would have a minor to moderate adverse effect on wildlife through habitat disturbance, noise, human presence, and operation of heavy equipment. Implementation of Best Management Practices such as preconstruction wildlife surveys and erosion and sedimentation control measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce the magnitude of the adverse effects on wildlife to minor.

Operational effects under Alternative 3 would have a local, long-term, major, beneficial effect on wildlife due to an overall increase in riparian discharges, and concomitant increases in aquatic and riparian habitat availability in the Furnace Creek area. In the long term, the re-establishment of historic wetlands in the Furnace Creek area would have a beneficial effect on wildlife. Species that rely on surface water and riparian habitat, such as aquatic invertebrates, amphibians, riparian-dependant bird species, and mammals would benefit from these activities. The expected wildlife benefits of re-establishing riparian flows in existing and historic channels at Travertine Springs, and thus, increasing the total amount of aquatic and riparian habitat availability compared to Alternative 1, would be expected to outweigh the negligible, adverse effects of 24% reduction in discharges at springs located between Travertine and Texas Springs and the loss of 155 gpm of groundwater recharge at the Inn Tunnel. In addition, on average, 86 gpm of concentrate water would recharge the groundwater in Furnace Creek Wash, somewhat offsetting the loss of groundwater recharge from the Inn Tunnel.

The beneficial effects associated with the re-establishment of wildlife habitat at Travertine Springs Lines 2, 3, and 4, and the extension of such habitat in the Furnace Creek Wash due to the relocation of the collection gallery, would outweigh the adverse construction-related effects, potential groundwater pumping-related and erosional impacts associated with this alternative. Alternative 3 would have local, long-term, major, beneficial impact on common wildlife.

Effects on Special-status Riparian and Wetland-dependent Wildlife Species

Construction activities associated with Alternative 3 would have a local, short-term, minor to moderate, adverse impact to special-status species (see Chapter IV, Environmental Consequences, Alternative 3, Special-status Species for a further description of impacts on special-status wildlife species). Activities that decrease the amount and distribution of special-status species habitat, or the size, connectivity, or integrity of such habitat would adversely affect special-status species. Project activities that increase habituation of wildlife to humans, cause incidental mortality of wildlife species, or disrupt breeding or foraging behavior also would adversely affect special-status species. Construction activities associated with spring box reconstruction effort could result in injury or mortality of subterranean invertebrates if construction equipment, materials, or wastes come into contact with spring water. Implementation of Best Management Practices and Mitigation Measures such as preconstruction surveys and maintenance of routes of escape from excavated pits and trenches for animals that might fall in (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce the magnitude of the adverse effects on special-status species to minor.

Operational effects under the preferred alternative would result in a local, long-term, major, beneficial impact on special-status wildlife species because of the overall emphasis on restoring disturbed or entirely eliminated aquatic and riparian habitat to natural conditions and improving the health of ecosystems. There would be a substantial increase in riparian discharges, and concomitant increases in aquatic and riparian habitat availability in the Furnace Creek area. According to a previous assessment, return of surface flows to the dry channel located south of the Travertine Springs Line 2 collection gallery offers the best opportunity for restoring historical Furnace Creek wetland and riparian habitats because the channel is relatively intact and relatively long in length (Threloff 2001). Although the length of potential channels below Travertine Springs Lines 3 and 4 is considerably less than below Travertine Springs Line 2, restoration of these channels would nevertheless expand potential habitat for special-status invertebrate species. Conversely, existing conditions at Texas Springs and the spring complex located between Travertine and Texas Springs do not provide significant habitat potential for special-status invertebrate species (Threloff 2005). Re-establishment of the historic wetlands at Travertine Springs, as well as the extension of aquatic habitat in Furnace Creek Wash due to the downstream relocation of the collection gallery, would be expected to have major, beneficial effects on the extent and quality of special-status wildlife species habitat.

The beneficial effects associated with the re-establishment of wetland and riparian habitat at Travertine Springs Lines 2, 3, and 4, and the extension of such habitat in the Furnace Creek Wash area due to the relocation of the collection gallery, would outweigh the adverse construction-related and groundwater pumping-related impacts, and the potential effects of erosion at the spring discharge locations. Under Alternative 3, the currently dry spring channels associated with Travertine Springs Lines 2, 3, and 4 would likely be devoid of aquatic invertebrates when riparian discharges would be reinitiated. The transfer of inoculated sediments from Travertine Springs Line 1 may provide the most effective approach of reintroducing special-status invertebrates into historic channels. The accidental reintroduction of invertebrates into the Texas Springs channels after riparian discharges at that location were re-established indicates that this approach likely would be successful (Threloff 2001).

Effects on Special-status Riparian and Wetland-dependent Plant Species

Overall, the preferred alternative would result in a local, long-term, major, beneficial impact on riparian and wetland dependent special-status plants (see Chapter IV, Environmental Consequences, Alternative 3, Special-status Species for a further description of impacts on special-status plant species). Long-term beneficial effects of the project would outweigh the temporary, negligible to minor, adverse effects associated with construction-related activities and groundwater pumping-related effects.

Construction effects as a result of Alternative 3 would be related to trenching and excavating activities, or clearing and grubbing, and could result in temporary disturbance or mortality to known or potentially occurring special-status plant species. Temporary construction-related effects could include minimal trampling in work areas resulting in minor, adverse effects on known or potentially occurring special-status plant species. Trampling effects could result in erosion, community fragmentation, root damage, and plant mortality at localized areas. Disturbance in these areas could create favorable conditions for the introduction or spread of invasive non-native plant species, such as Bermuda grass. Invasive plant species could form monocultures and displace native plant species, and as a result change the species composition.

As identified in Appendix D, Mitigation Measures Common to All Action Alternatives, implementation of Best Management Practices and mitigation measures (e.g., conducting pre-construction surveys, avoiding disturbance to special-status species to the maximum extent feasible, restoring disturbed areas, confining construction work areas with appropriate fencing materials, and implementing a natural resource program and a non-native invasive species program), would reduce the intensity of construction-related effects to negligible to minor.

Operation-related effects on special-status plant species in the project area would moderately improve following implementation of the preferred alternative due to increased riparian discharges to all of the lines at Travertine Springs, compared to Alternative 1. Increased riparian discharges would result in greatly improved size and quality of habitat conditions for plant populations, and improved population dynamics and increased plant species diversity and richness. Flows would re-establish formerly dry riparian areas, such as the area downstream of Travertine Springs Line 2. These actions would result in a local, long-term, major, beneficial impact on special-status plants. Increased discharges would also potentially encourage the spread of non-native invasive plant species, including date palm, California fan palm, and tamarisk. Tamarisk would be removed as part of the on-going tamarisk eradication program. Invasive plant species could continue to displace native plant species and reduce the diversity of native plant species, which would result in a moderate, adverse effect; however, non-native species could be controlled better under this alternative than compared to Alternative 1 through the use of appropriate chemical controls.

As identified in Appendix D, Mitigation Measures Common to All Action Alternatives, implementation of best management practices and mitigation measures (e.g., implementing a non-native invasive species program, a natural resource program and a revegetation program) would reduce adverse operation-related effects associated with spread of invasive plant species to minor.

Design or Modifications to Minimize Harm to the Wetland and Floodplains

Although the preferred alternative has been designed to mitigate harmful effects to the floodplain and wetlands, the National Park Service (and its contractors) would implement mitigation measures prior to, during and after construction, as appropriate. These mitigation measures are identified in Appendix D, Mitigation Measures Common to All Action Alternatives.

Proposed Compensation

The exact number of acres of restored wetland and riparian habitat is unknown. An estimation of the number of acres of restored wetland and riparian habitat was developed based on the proposed allocated flow rates, historic wetland locations, and previous assessments of eliminating water diversion activities (Threloff and Koenig 1999). Impacts to wetlands would be compensated at a minimum 1 for 1 acreage basis as part of the preferred alternative restoration actions. The project would mitigate for impacts to approximately 0.008 acres of palustrine emergent and approximately 0.005 acres of riverine intermittent streambed due to construction effects. Additionally, due to groundwater pumping operational effects, the project would mitigate for impacts to approximately three acres of wetlands, including approximately 1.8 acres of palustrine emergent (1.4 acres on fine soil types and 0.4 acres on coarse soil types), 1.0 acres of palustrine scrub shrub on fine soil types, 0.002 acres of palustrine aquatic bed on coarse soil types, and 0.14 acres of riverine wetlands (0.11 acres on fine soil types and 0.03 acres on coarse soil types).

Restoration under the preferred alternative would offset the adverse construction-related impacts and improve the connectivity, integrity and value of the floodplain and its associated wetlands in the project area. Overall, wetland compensation would restore approximately 60 acres of palustrine and riverine wetland habitats (see figure E-11).[11] Wetland compensation would restore approximately 29 acres of palustrine emergent and palustrine scrub-shrub (23 acres on fine soil types and 6 acres on coarse soil types), 28 acres of riverine intermittent on coarse soil, and 3 acres of riverine lower perennial on coarse soil types within the project area at Furnace Creek Wash, Travertine Springs and Texas Springs (see figure E-11 and table E-3). Riverine upper perennial also would be restored primarily at Travertine Springs and potentially at Texas Springs. Increased flows to Furnace Creek Wash would result in new riverine wetland types (riverine lower perennial and riverine intermittent streambed) at the Furnace Creek Fan. Wetland compensation will focus on bare areas resulting from the removal of woody, non-native, invasive wetland species, areas currently supporting non-native, invasive wetland species, and dry historic springs (including existing springs with limited flows). These types of compensation areas are located at Travertine Springs, Texas Springs, and Furnace Creek Wash.

The following represents conceptual compensation methods for Furnace Creek Wash, Travertine Springs (near Line 2) and Texas Springs. Restoration activities at Texas Springs would include expanding existing wetlands. As stated in Appendix D, Mitigation Measures Common to All Action Alternatives, a detailed restoration plan will be prepared specific to restored areas.

Control of Invasive Species

Tamarisk will continue to be removed and non-native grasses will be removed to the extent feasible. Palms, primarily near Travertine Springs Line 2 will be sprayed with an aquatic herbicide, such as glyphosate, and will be left in place to avoid erosion and expensive removal costs.

Planting

Planting would begin when the release of water establishes into discrete drainage patterns and the riparian water releases have been implemented. All planting would start upstream and continue downstream a few hundred meters over two to three years. To the extent feasible supplemental watering would be avoided.

For permanently flooded areas, herbaceous emergent native plantings, such as six by six-inch plugs of rushes, cattail and bulrush would be collected from existing wetlands within the project area and planted in areas supporting suitable saturated soil conditions. For seasonally flooded areas, woody shrubs, such as arrowweed, screwbean and honey mesquite, and Goodings black willow and/or narrowleaf willow (sandbar willow) would be installed at appropriate plant densities. Plugs of arrowweed will be collected from the Furnace Creek area and planted at Travertine Springs, Texas Springs, and Furnace Creek Wash. Seeds of mesquite would be collected from the Furnace Creek area and germinated to the seedling stage on site, and at National Park Service operated nurseries at either Lake Mead National Recreational Area or Joshua Tree National Park. Willow cuttings would be collected from the park such as at Lower Vine Ranch (the closest remaining population of Goodings black willow in the park) over time to avoid decimating the source population. Over time, existing plants, such as cattail, would naturally disperse in restoration sites supporting saturated soil conditions, and shrubs, such as willow, screwbean mesquite, and arrowweed, would re-colonize the banks of seasonally flooded channels. All temporarily disturbed wetland areas would be restored using appropriate native

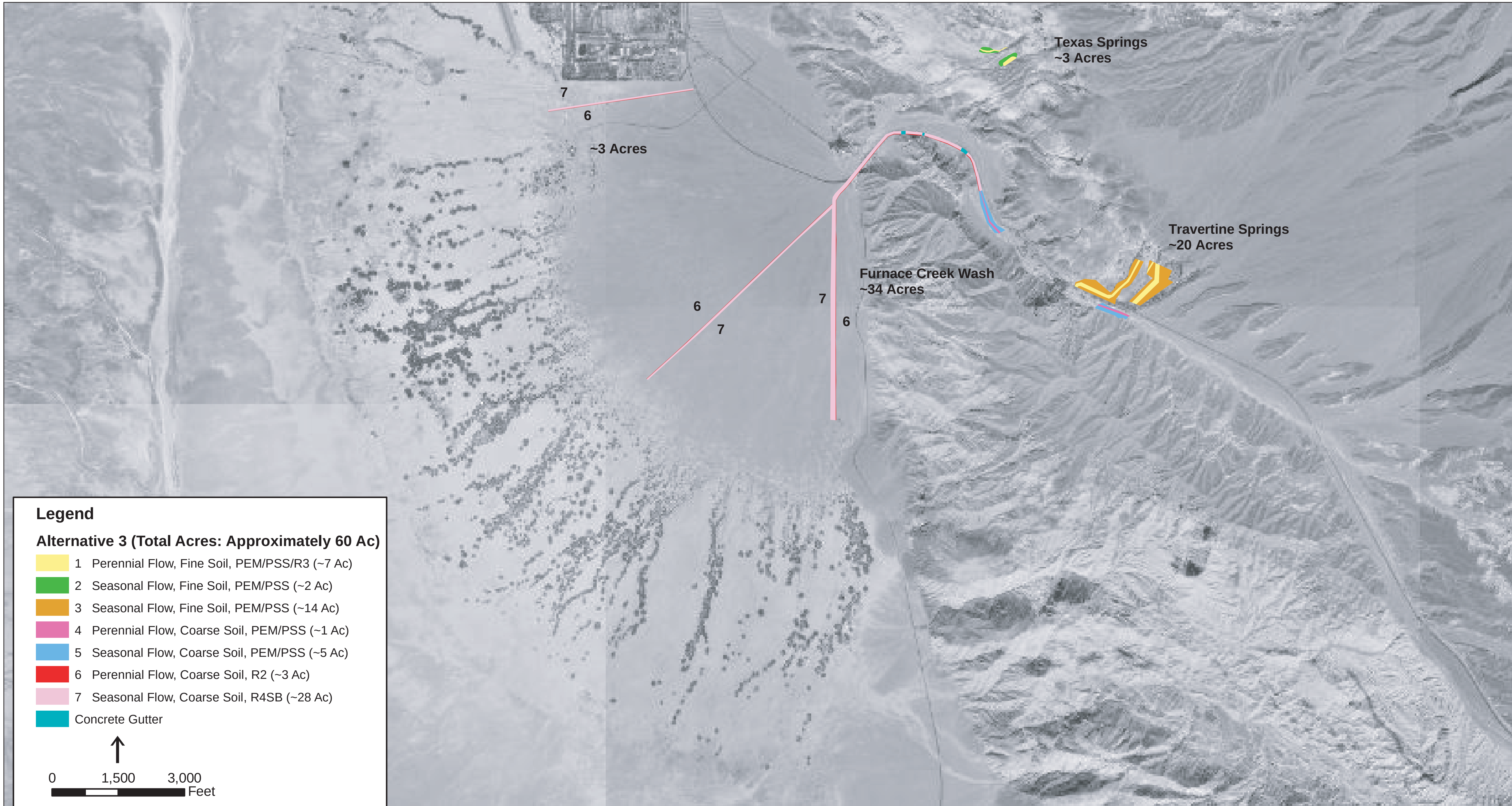
[11] The figure depicts one particular flow path on the Furnace Creek alluvial fan. The flow path will vary seasonally and may not follow this particular path.

TABLE E-3
Areas of Affected and New Wetland Habitat in the Furnace Creek Area Due to Construction and Operational Effects

Cowardin Classification Category	Operation Effects Based on 24% Reduction (Acres)	Construction Effects (Acres)	New Areas Restored (Approximate Acres)
Travertine Springs (Fine Soil Types)			
Riverine Upper Perennial	0.06	--	20 acres of R3, PSS and PEM
Palustrine Scrub-shrub (saturated, temporarily flooded, seasonally flooded)	0.03	--	
Palustrine Emergent (saturated)	0.50	0.008	
Texas Springs (Fine Soil Types)			
Riverine Upper Perennial	0.03	--	3 acres of PSS and PEM; Riverine habitats would be restored at Travertine Springs and Furnace Creek alluvial fan
Riverine Intermittent Streambed	0.02	--	
Palustrine Scrub-shrub (saturated, temporarily flooded, seasonally flooded)	0.60	--	
Palustrine Emergent (saturated)	0.80	--	
Furnace Creek Wash and Fan (Coarse Soil Types)			
Riverine Lower Perennial	--	--	3 acres of R2 28 acres of R4SB 6 acres of PEM/PSS
Riverine Upper Perennial	0.01	--	
Riverine Intermittent Streambed	0.02	.005	
Palustrine Scrub-shrub (saturated, temporarily flooded, seasonally flooded)	--	--	
Palustrine Emergent (saturated)	0.32	--	
Palustrine Aquatic Bed	.002	--	
Springs between Texas Springs and Travertine Springs (Fine Soil)			
Palustrine Scrub-shrub (saturated, temporarily flooded, seasonally flooded)	0.41	--	No wetlands restored in this area; however, PEM and PSS habitats would be restored at Travertine Springs, Texas Springs and Furnace Creek Wash
Palustrine Emergent (saturated)	0.15	--	

Codes
Riverine Lower Perennial = R2
Riverine Upper Perennial = R3
Riverine Intermittent Streambed = R4SB
Palustrine Scrub-shrub (saturated, temporarily flooded, seasonally flooded) = PSS, PSSB, PSSA, PSSC
Palustrine Emergent (saturated) = PEM, PEMB
Palustrine Aquatic Bed = PAB

Figure E-11
Alternative 3: Proposed Areas of Wetland Restoration



NOTE: This figure depicts one particular flow path on the Furnace Creek alluvial fan.
The flow path will vary seasonally and may not follow this particular path.

SOURCE: Environmental Science Associates and National Park Service

seed mix, including screwbean and honey mesquite, and plugs of arrowweed and Goodings black willow and/or narrowleaf willow to avoid establishment of non-native, invasive species. Vegetation at some of the spring sites would be allowed to re-establish naturally as a result of increasing flows to historic springs.

Erosion Control

Erosion control is necessary mainly on the finer soil types around Texas Springs and Travertine Springs. In Furnace Creek Wash and on the alluvial fan, the soil types are much coarser, so erosion is less of a problem. Implementation of the Riparian Water Releases described in Chapter II, Alternatives would mostly control erosion on fine soil types; however, the use of biodegradable erosion control mats in areas where fine soil types are expected to be saturated may be necessary. Erosion control mats may be used around plantings, and to line infiltration ditches, in conjunction with drip or weep pipes, diffusion piping, straw waddles, and other devices.

Monitoring

The exact number of acres of wetlands that would be restored and loss due to operational effects is unknown. Monitoring would include evaluating existing affected wetlands to monitor the loss of wetlands due to groundwater pumping as well as restored wetlands to monitor wetland gain. The full effects of groundwater pumping would not be observed for 10 or 20 years. Monitoring of the affected wetlands would occur to observe partial effects and full effects. Affected wetlands would be monitored after the first year of groundwater pumping, the fifth year, the tenth year, and then biannually (every two years) for a period of ten years. Monitoring may include measuring the spring flow rate and evaluating plant health and vigor. The period of monitoring may be adjusted so that the effects of pumping would be observable.

Restored wetlands would be monitored annually, at a minimum, by a qualified natural resource staff for the first three years following planting. Monitoring would ensure successful restoration, maintenance of plantings, and replacement of unsuccessful plant materials. Subsequent monitoring would occur biannually (every two years) for a period of ten years after three years or when the plants have established successfully. Monitoring reports would be filed as part of the administrative record and submitted to the appropriate parties. Areas containing erosion control materials would be monitored in accordance with the riparian water releases.

Funding Sources

No exact funding sources have been identified at this time, but funding sources would come from fees, and construction and park base funds.

Site-Specific Mitigation — Subsequent Statement of Findings Necessary

The Reconstruction of the Furnace Creek Water Collection System does not include any elements that would require preparation of subsequent Statement of Findings.

Justification

One of the main purposes of the project is to restore historic wetland and riparian habitat, and ensure the long-term conservation of species endemic to the Furnace Creek area while providing a reliable quality and quantity of potable water for local users. In proposing this action, the National Park Service would also improve wetland conditions in the Furnace Creek area.

The National Park Service has determined that there is no practicable alternative that would be located outside the floodplain or wetland habitat. There are slight differences in the extent of wetland disturbance due to construction-related effects among the action alternatives. Compared to the other action alternatives, the preferred alternative would result in greater operational effects (24% reduction) on the extent of wetlands due to groundwater pumping. However, the National Park Service identified Alternative 3 as the preferred alternative because of its preferred balance of providing a sufficient amount of potable water and allowing the greatest release of water to the Texas Spring and Travertine Springs complex. Alternative 3 also would increase flows to Furnace Creek Wash, the alluvial fan, and potentially the mesquite bosque. Thus, the preferred alternative would allow the greatest potential area for restoring wetland habitats (approximately 60 acres) in the Furnace Creek area, whereas the other action alternatives would allow reduced flows and limited potential areas for restoring wetland habitats (approximately 38 acres under Alternative 2 and approximately 35 acres under Alternative 4).

Conclusion

The preferred alternative would affect approximately 0.013 acre of riverine and palustrine wetlands within the project area due to construction-related effects. These impacts would result from construction of 3 culverts under Highway 190 downslope of Travertine Springs Line 1 (potentially within approximately 0.008 acres of palustrine emergent wetland habitat), and installing a new collection gallery and pipeline for connection at the Inn Tunnel adjacent to riverine intermittent streambed in Furnace Creek Wash. Minimal trampling and erosion would occur during construction for the culverts and collection gallery, as well as during removal of the wash measurement box and capping of the water lines in Furnace Creek Wash.

Due to groundwater pumping operational effects, the project would result in the loss of approximately three acres of wetlands, including approximately 1.8 acres of palustrine emergent (1.4 acres on fine soil types and 0.4 acres on coarse soil types), 1.0 acres of palustrine scrub shrub on fine soil types, 0.002 acres of palustrine aquatic bed on coarse soil types, and 0.14 acres of riverine wetlands (0.11 acres on fine soil types and 0.03 acres on coarse soil types).

As a result of current water diversion activities, these riverine and palustrine wetlands have minor functional value because of the absence of riparian vegetation at riverine wetlands, limited extent of palustrine wetlands, minor habitat value for wildlife (including riparian and aquatic special-status species), limited scenic and recreational value, and limited cultural value.

Alternative 3 would result in an approximately 130% (435 gpm more than 335 gpm under Alternative 1) increase in water released for riparian flow, primarily from Travertine Springs Lines 2, 3 and 4 (515 gpm), which is the largest spring system in the project area. Compared to Alternative 1, these flow rates would represent an increase in riparian discharges at Travertine Springs Line 2, 3, and 4 under the preferred alternative. Groundwater recharge to Furnace Creek Wash at the Inn Tunnel would be discontinued. However, on average, 86 gpm of concentrate water would be discharged for groundwater recharge to Furnace Creek Wash and would, somewhat offset the loss of groundwater recharge from the Inn Tunnel. Furthermore, increased riparian releases at Travertine Springs Lines 2, 3, and 4 would augment groundwater flows downgradient. The benefits of expanding wetlands and improving wildlife habitat conditions as a result of re-established riparian flows would outweigh the negligible and minor adverse operation-related effects associated with minor reductions in discharge. Furthermore, the preferred alternative would improve habitat conditions for special-status invertebrates.

Restoration under the preferred alternative would offset the adverse construction-related impacts and improve the connectivity, integrity, and value of the floodplain and its associated wetlands in the project area. Overall, wetland compensation would restore approximately 60 acres of palustrine and riverine wetland habitats. Wetland compensation would restore approximately 29 acres of palustrine emergent and palustrine scrub-shrub, 28 acres of riverine intermittent, and 3 acres of riverine lower perennial within the project area at Furnace Creek Wash, Travertine Springs, and Texas Springs.

Overall, the preferred alternative would have a local, long-term, negligible, beneficial impact to the floodplain and major, beneficial impact on wetlands. The preferred alternative would improve the conditions of the 100-year floodplain by relocating the Furnace Creek measurement box downstream of its existing location and including subsurface water conveyance lines and collection gallery in the wash. The preferred alternative would include the re-establishment and restoration of aquatic and riparian habitat along Furnace Creek Wash as a result of the relocation of the Furnace Creek Wash collection gallery to the downstream end of the wash. The preferred alternative would continue to eradicate non-native plants, such as tamarisk, re-establish natural riparian habitat in the floodplain, and allow natural establishment in historic springs. The beneficial effects associated with restoration under the proposed action would offset the adverse construction-related impacts. Implementation of Best Management Practices and biological resources protection measures (see Appendix D, Mitigation Measures Common to All Action Alternatives), would reduce effects of construction- and operation-related impacts on wetlands.

The wetlands in the Furnace Creek area are not within the jurisdiction of the U.S. Army Corps of Engineers, and therefore are not regulated under Sections 401 and 404 of the Clean Water Act. As a result, neither a U.S. Army Corps of Engineers Section 404 wetland permit nor a Lahontan Regional Water Quality Control Board Section 401 wetland permit would be required for the project. A Waste Discharge Requirement for discharges to groundwater and waters deemed by the U.S. Army Corps of Engineers to be outside federal jurisdiction, or a demonstration of avoidance of water quality effects, may be required by the Lahontan Regional Water Quality Control Board under the Porter-Cologne Water Quality Act. Other permits or compliance documentation from the Lahontan Regional Water Quality Control Board may include a National Pollution Discharge Elimination System Permit for construction activities (General Construction Activity Stormwater Permit). Mitigation and compliance with regulations and policies, as required, to avoid or minimize impacts on water quality and wetland function and values would be strictly adhered to during and after project construction. The National Park Service will consult with the Lahontan Regional Water Quality Control Board to determine the requirements for the preferred alternative.

No long-term, major, adverse impacts to floodplains or wetlands would occur as a result of the proposed action. Impacts to disturbed wetlands would be compensated at a minimum of 1-acre for 1-acre basis as part of the preferred alternative restoration actions. Restoration under the proposed action would offset the adverse construction-related impacts and improve the connectivity, integrity, and value of the floodplain and historic springs in the project area. The preferred alternative would result in a net gain of restored wetland area and functional value. Therefore, the National Park Service finds the proposed action to be consistent with Director's Order 77-1, including the no net loss wetland policy, and Director's Order 77-2. The Reconstruction of the Furnace Creek Water Collection System does not include any elements that would require preparation of a subsequent Statement of Findings.